SOIL SURVEY OF

Bryan County, Oklahoma

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Oklahoma Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1962-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1974. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the Bryan County Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, woodlands, and wildlife areas; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Bryan County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the woodland group and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites and woodland groups.

Foresters and others can refer to the section "Woodland Management and Productivity" where the soils of the county are grouped according to their suitability for trees.

Wildlife managers and others can find information about soils and wildlife in the section "Wildlife Habitat."

Ranchers and others can find, under "Use of the Soils for Rangeland," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the sections "Engineering" and "Recreation."

Engineers and builders can find, under "Soil Properties," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about the soils in the section "Formation and Classification of the Soils."

Newcomers in the area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication in the section "General Nature of the County."

Cover: **Cotton on Durant loam, 1 to 3 percent slopes.**

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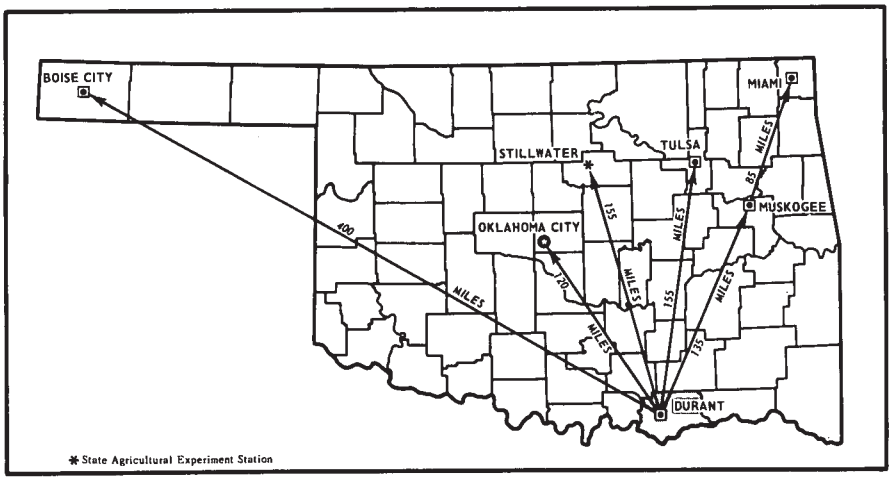

Location of Bryan County in Oklahoma.

SOIL SURVEY OF BRYAN COUNTY, OKLAHOMA

By Everett L. Cole and Carter A. Steers, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service in cooperation with Oklahoma Agricultural Experiment Station

BRYAN COUNTY is in the south-central part of Oklahoma (see map on facing page). Durant, the county seat, is in the west-central part of the county. The county has an area of 594,560 acres, or 929 square miles.

General Nature of the County

This section discusses the climate, settlement and development, relief and drainage, natural resources, and transportation and industry of Bryan County.

Climate

The climate of Bryan County is moist-subhumid. The average yearly precipitation is sufficient for most field crops commonly grown in the county. Supplemental irrigation to obtain maximum crop yields is used on some field crops grown during summer.

Table 1 gives data on temperature and precipitation for the county as recorded at Durant for the period 1941-70. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring.

In winter the average temperature is 44° F and the average daily minimum temperature is 33°. The lowest temperature on record, −6°, occurred at Durant on January 18, 1930. In summer the average temperature is 81° and the average daily maximum is 94°. The maximum temperature on record, 118°, occurred at Durant on August 10, 1936.

As shown in table 1, the total precipitation is 40 inches. Of this total, 24 inches, or 60 percent, usually falls during the period April through September, which includes the growing season for most crops. The heaviest 1-day rainfall during the period of record was 7.4 inches at Durant in August 1926. Thunderstorms number about 50 each year, most of which occur in May.

Average seasonal snowfall is 3.5 inches. The greatest snow depth at any one time during the period of record was 12.5 inches. On the average, 2 days have at least 1 inch of snow on the ground.

The average relative humidity in midafternoon in spring is less than 45 percent; during the rest of the year it is about 60 percent. Humidity is higher at night in all seasons, and the average at dawn is about 80 percent. The percentage of possible sunshine is 70.

TABLE 1.—*Temperature and precipitation data*

[All data from Durant]

Month	Temperature[1]			Precipitation[1]			
	Average daily maximum	Average daily minimum	Average monthly	Average monthly total	Greatest daily	Greatest daily snowfall	Average snowfall
	°F	°F	°F	In	In	In	In
January	53	31	42	1.9	3.8	7	1.5
February	58	35	46	2.8	3.2	7	1.2
March	65	42	53	3.0	3.2	3	.4
April	76	52	64	4.9	5.2	0	0
May	82	60	71	5.3	5.4	0	0
June	90	67	79	4.0	4.0	0	0
July	95	70	83	2.9	5.4	0	0
August	96	70	83	2.5	7.4	0	0
September	88	62	75	4.5	4.2	0	0
October	78	52	65	3.4	5.0	0	0
November	65	41	54	2.7	4.1	(2)	0
December	56	33	44	2.4	5.8	3	.4
Year	75	51	63	40.3	7.4	7	3.5

[1]Based on 1941-70 data.

[2]Trace.

TABLE 2.—*Probability of last freezing temperatures in spring and first in fall*

Probability	Dates for given probability and temperature		
	20° F or lower	28° F or lower	32° F or lower
Spring:			
10 percent later than	Mar. 11	Mar. 31	Apr. 16
25 percent later than	Feb. 26	Mar. 24	Apr. 8
50 percent later than	Feb. 12	Mar. 15	Mar. 30
75 percent later than	Jan. 29	Mar. 6	Mar. 21
90 percent later than	Jan. 16	Feb. 27	Mar. 13
Fall:			
10 percent earlier than	Nov. 23	Oct. 30	Oct. 24
25 percent earlier than	Dec. 3	Nov. 9	Oct. 31
50 percent earlier than	Dec. 15	Nov. 19	Nov. 8
75 percent earlier than	Jan. 5	Nov. 30	Nov. 15
90 percent earlier than	(1)	Dec. 9	Nov. 22

[1]The probability of a temperature of 20° is less than 90 percent.

The prevailing direction of the wind is from the south. Average windspeed is highest, 14 miles per hour, in March and April.

Settlement and Development

The early settlement of Bryan County was mostly by Choctaw Indians. Land was allotted to the Indians on the basis of cash value, and the largest allotments in size were on the rolling, timbered soils. Land could also be leased for farming subject to the supervision of the Indian Agency. The sale or lease of the land brought other settlers into the county.

Most of the early settlers farmed on small subsistence acreage. In the timbered areas, the land had to be cleared before it could be cultivated. Cotton, grain sorghum, peanuts, small grain, and alfalfa hay were the major cash crops, and other crops were grown to feed horses, mules, hogs, chickens, and beef and milk cattle. Some settlers quit farming and sold out because they found the land they had bought was not suitable to make a living. Farmers in other areas acquired this land, and farm units increased in size. Farmers specialized in certain types of crop and livestock enterprises to increase efficiency in managing larger farm units. Farms became more mechanized. The farmers started using irrigation to supplement the moisture available to field crops and they converted old cultivated areas to tame pasture plants. One large reservoir was built on the Red River for municipal and industrial purposes. Some industries were established.

Relief and Drainage

Bryan County is predominantly nearly level to gently sloping, but there are some more strongly sloping areas along drainageways. The general slope is from the north to the south. The Red, Blue, and Washita Rivers drain most of the county. Mineral Bayou, Island Bayou, Clear Boggy, and White Grass Creeks are the main streams draining into the rivers. These rivers and creeks are entrenched to a depth of about 30 to 100 feet.

The county includes such diverse areas as prairies, blacklands, timber lands, and flood plains. The divides between drainageways are nearly level to sloping and are ½ mile to 4 miles wide, but the slopes that extend into the drainageways are strongly sloping to moderately steep. The drainageways range from about 200 feet wide along the smallest streams to about 3 miles wide along some of the rivers. The areas along these drainageways are nearly level flood plains and nearly level to gently sloping stream terraces.

Natural Resources

The natural resources of the county are mainly soil, water, timber, oil, limestone, wild game and fish, gravel, and scenic beauty.

The soil is the most important natural resource in the county. It produces grass for livestock, timber, crops, and mineral resources that are necessary to sustain the dominant part of the economy in the county.

The water supply for towns is mainly from wells and reservoirs. Hydroelectric and flood-control reservoirs furnish recreation, electricity, and irrigation water. Farm ponds supply water for livestock needs.

Most of the timber has been cut over, and the trees that were left to propagate the stands are of poor quality. This timber is used mainly for lumber.

Oil furnishes additional income and provides jobs to the community. Most of the oil wells are in the western part of the county.

Limestone is the most common surface mineral in the area. It is mined in the northern part of the county for roads, commercial purposes, and ranching and farming. In some areas, this mineral is of excellent quality for agricultural lime.

Wildlife and game are abundant in the survey area. Deer, quail, dove, rabbit, and duck are hunted in season. Ducks are furnished a resting area on a game reserve along the Washita River.

In the survey area deposits of gravel along streams are a limited natural resource. Some very good gravel is located near Yarnaby. The gravel is used mainly for concrete and roads.

Clear running streams, small ponds, and lakes attract thousands of visitors each year. Visitors are most numerous in the Lake Texoma area during spring and summer. Recreation facilities are provided.

Transportation and Industry

Railroads, State and Federal highways, and county roads form a network of transportation facilities in the county. The St. Louis-San Francisco railway crosses the county from east to west, and the Missouri-

Kansas-Texas railway crosses it from north to south. U.S. Highways 69 and 75 and State Routes 78, 22, and 48 cross the county from north to south, and U.S. Highway 70 crosses it from east to west. In farm areas, dirt, gravel, and paved roads provide access to State and Federal highways.

Grain, peanuts, timber, and livestock are marketed at Durant. Cotton is ginned, and limestone is mined for commercial and agricultural purposes in the northern part of the county near Kenefic. One nursery near Durant sells flowering plants and shrubbery.

Most of the other industries are small commercial types located near Durant. Some of these industries are clothing, toy, and stock trailer factories and several industries that work with steel.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are located, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Soil series commonly are named for towns or other geographic features near the place where they were first observed and mapped. Durant and Matoy, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in characteristics.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Durant loam, 1 to 3 percent slopes, is one of several phases within the Durant series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a named soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series, and some have little or no soil. These kinds of mapping units are discussed in the section "Descriptions of the Soils."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. Existing ratings of suitabilities and limitations (interpretations) of the soils are field tested and modified as necessary during the course of the survey, and new interpretations are added to meet local needs. This is done mainly through field observations of behavior of different kinds of soil for different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and other information available from state and local specialists. For example, data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so it will be readily useful to different groups, among them farmers, managers of rangeland and woodland, engineers, planners, developers, and builders, homebuyers, and those seeking recreation. Presenting the detailed information in an organized, understandable manner is the purpose of this publication.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of

that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning of a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey area are described on the pages that follow.

1. Verdigris-Kaufman-Kiomatia association

Deep, nearly level, well drained to somewhat poorly drained, sandy to clayey soils that have a sandy to clayey subsoil over sandy to clayey sediment; on flood plains

This association makes up about 18 percent of the county. It is about 20 percent Verdigris soils, 11 percent Kaufman soils, and 8 percent Kiomatia soils. Frioton, Gowton, Madill, Muldrow, Norwood, Oklared, Pledger, Redport, Severn, Ships, Trinity, and Tullahassee soils make up the remaining 61 percent.

The Verdigris soils are deep, nearly level, and moderately well drained. They have a loamy surface layer and a loamy subsoil. These soils are moderately permeable, and they are occasionally flooded.

The Kaufman soils are deep, nearly level, and somewhat poorly drained. They have a clayey surface layer over a clayey subsoil. These soils are very slowly permeable, and they are occasionally flooded to frequently flooded.

The Kiomatia soils are deep, nearly level, and well drained. They have a loamy or sandy surface layer and a mostly sandy subsoil. These soils are rapidly permeable and are subject to rare to frequent flooding.

Most of the soils in this association are used for bermudagrass or tall fescue, alfalfa hay, peanuts, soybeans, cotton, grain sorghum, and small grain. About 40 percent of the soils is used for cultivated crops, 50 percent for introduced grasses, and 10 percent for woodland and wildlife.

The main management concerns for these soils are preventing flooding and maintaining tilth and fertility. The soils respond to a suitable cropping system, plant food, and residue management.

2. Muskogee-Boxville association

Deep, nearly level to sloping, moderately well drained or well drained, loamy soils that have a loamy or clayey subsoil over loamy or clayey sediment; on uplands

This association makes up about 16 percent of the county. About 29 percent of this association is Muskogee soils, and 20 percent is Boxville soils. Larton, Tullahassee, Muldrow, Freestone, Okay, Eufaula, Bosville, Karma, Bernow, Durant, Dennis, Parsons, and Guyton soils and Pits make up the remaining 51 percent.

The Muskogee soils are deep, nearly level to gently sloping, and moderately well drained. They have a loamy surface layer and a loamy and clayey subsoil. These soils are slowly permeable.

The Boxville soils are deep, very gently sloping to sloping, and well drained. They have a loamy surface layer and a loamy and clayey subsoil. These soils are slowly permeable.

Most of the soils in this association are used for bermudagrass pasture. About 30 percent is used for peanuts, soybeans, cotton, grain sorghum, and small grain. About 10 percent is used for woodland and wildlife.

The main management concerns for these soils are preventing excessive erosion and maintaining tilth and fertility. The soils can be properly managed by using a suitable cropping system, residue management, and terraces on slopes of more than 1 percent.

3. Bernow-Bosville association

Deep, very gently sloping to sloping, moderately well drained or well drained, loamy or sandy soils that have a loamy or clayey subsoil over loamy or clayey sediment; on uplands

This association makes up about 15 percent of the county. About 55 percent of this association is Bernow soils, and 17 percent is Bosville soils. Larue, Boxville, Freestone, Madill, Tullahassee, Woodtell, Romia, and Muskogee soils make up the remaining 28 percent.

The Bernow soils are deep, very gently sloping to sloping, and well drained. They are loamy or sandy soils that have a loamy subsoil over loamy sediment. These soils are moderately permeable.

The Bosville soils are deep, very gently sloping to sloping, and moderately well drained. They are loamy soils that have a loamy or clayey subsoil over loamy or clayey sediment. These soils are very slowly permeable.

The soils in this association are mostly used for bermudagrass pasture. About 10 percent of the area is used for peanuts, grain sorghum, and other crops. About 40 percent is used for woodland and wildlife.

The main management concerns are controlling erosion and maintaining tilth and fertility. Where cultivated, these soils can be managed by using plant food for maximum vegetative growth, a suitable cropping system, residue management, and terraces on the loamy soils.

4. Burleson-Ferris association

Deep, nearly level to gently sloping, moderately well drained or well drained, clayey soils that have a clayey subsoil over clayey sediment or shaly clay; on uplands

This association makes up about 8 percent of the county. About 64 percent of this association is Burleson soils, and 10 percent is Ferris soils. Heiden, Frioton, Kaufman, San Saba, Tarrant, Trinity, and Matoy soils and Pits make up the remaining 26 percent.

The Burleson soils are deep, nearly level to gently sloping, and moderately well drained. They are clayey throughout and are very slowly permeable.

The Ferris soils are deep, very gently sloping to gently sloping, and well drained. They are clayey throughout and are very slowly permeable.

About 60 percent of this association is cultivated, and the rest is used as native range or for tame pasture plants. The most common crops are cotton and grain sorghum.

The main management concerns are preventing excessive erosion and maintaining tilth and infiltration. Using a suitable cropping system, plant food, and crop residue management is beneficial if these soils are cultivated. Terraces are needed for soils that have slopes of more than 1 percent.

5. *Ferris-Tarrant association*

Deep to shallow, very gently sloping to moderately steep, well drained, clayey or cobbly clayey soils that have a clayey or cobbly clayey subsoil over shaly clay or limestone; on uplands

This association makes up about 5 percent of the county. About 52 percent of this association is Ferris soils, and 21 percent is Tarrant soils. San Saba, Burleson, Frioton, Kaufman, Matoy, Trinity, and Heiden soils and rock outcrop make up the remaining 27 percent.

The Ferris soils are deep, very gently sloping to moderately steep, and well drained. They are clayey throughout and are very slowly permeable.

The Tarrant soils are shallow and are very gently sloping to moderately steep. They are cobbly and clayey throughout, and limestone is at a depth of less than 20 inches. These soils are moderately slowly permeable.

Most of the acreage of this association is in native range. A small part is in tame pasture plants.

The main management concerns are preventing excessive erosion and maintaining tilth and infiltration. Rotating grazing and the prevention of overgrazing are the main range management practices used on these soils.

6. *Durant-Dennis association*

Deep, nearly level to gently sloping, moderately well drained, loamy soils that have a loamy or clayey subsoil over loamy and clayey sediment; on uplands

This association makes up about 27 percent of the county. About 33 percent of this association is Durant soils, and 22 percent is Dennis soils. Bates, Catoosa, Crockett, Claremore, Collinsville, Fitzhugh, Gowton, Muskogee, Parsons, Verdigris, and Woodson soils make up the remaining 45 percent.

The Durant soils are deep, very gently sloping, and moderately well drained. They are loamy soils that have a clayey subsoil over clayey sediment. These soils are slowly permeable.

The Dennis soils are deep, nearly level to gently sloping, and moderately well drained. They are loamy soils that have a loamy or clayey subsoil over loamy or clayey sediment. These soils are slowly permeable.

About 60 percent of this association is cultivated, and most of the rest is in tame pasture plants. The main crops are peanuts, soybeans, grain sorghum, small grain, and cotton.

The main management concerns are preventing excessive erosion and maintaining tilth, fertility, and surface drainage. A suitable cropping system that includes proper residue management is beneficial in areas where this association is cultivated. Terraces are needed on soils with slopes of more than 1 percent. In some areas, the nearly level soils are insufficiently drained. Maintaining row direction for surface drainage is generally sufficient for good crop growth.

7. *Bernow-Romia association*

Deep, strongly sloping to moderately steep, well drained, sandy or loamy soils that have a loamy subsoil over loamy sediment or sandstone; on uplands

This association makes up about 11 percent of the county. This association is about 55 percent Bernow soils and 10 percent Romia soils. Ferris, Muskogee, Bosville, Larue, Madill, Tullahassee, and Woodtell soils make up the remaining 35 percent.

The Bernow soils are deep, strongly sloping, and well drained. They are loamy or sandy soils that have a loamy subsoil over loamy sediment. These soils are moderately permeable.

The Romia soils are deep, strongly sloping to moderately steep and well drained. They are cobbly sandy soils that have a loamy subsoil over sandstone that is at a depth of 40 to 60 inches. These soils are moderately permeable.

About 80 percent of this association is in woodland, and most of the rest is in tame pasture plants. The main management concerns are controlling excessive erosion and maintaining tilth and fertility. Rotation grazing and prevention of overgrazing are the main range management practices used on these soils.

Descriptions of the Soils

This section describes the soil series and mapping units in Bryan County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the

profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Pits, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and woodland group in which the mapping unit has been placed. The page for the description of each range site can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The approximate acreage and proportionate extent of the soils for each mapping unit are shown in table 3. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.[1]

Bates Series

The Bates series consists of very gently sloping to sloping soils on uplands. These soils formed in loamy material weathered from sandstone under a cover of grass.

In a representative profile the surface layer is very dark grayish brown fine sandy loam 11 inches thick. The upper part of the subsoil is dark yellowish brown loam 5 inches thick, and the lower part is yellowish brown clay loam 12 inches thick. Below this is fractured sandstone containing thin strata of rippable shale.

Bates soils are well drained and have moderate permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Bates fine sandy loam, 1 to 3 percent slopes, 2,400 feet east and 1,480 feet south of the northwest corner of sec. 23, T. 7 S., R. 9 E.:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, very friable; few fine sandstone fragments; neutral; gradual smooth boundary.

B1—11 to 16 inches; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry: moderate fine subangular blocky structure; slightly hard, friable; thin patchy clay films on faces of peds; few fine sandstone fragments; slightly acid; gradual smooth boundary.

B2t—16 to 28 inches; yellowish brown (10YR 5/6) clay loam, brownish yellow (10YR 6/6) dry; few fine faint yellowish brown mottles; moderate fine and medium subangular blocky structure; hard, firm; patchy clay films on faces of peds; few fine iron-manganese concretions; few fine sandstone fragments; medium acid; abrupt wavy boundary.

R—28 to 33 inches; fracture sandstone containing thin strata of shale.

The profile ranges from 20 to 40 inches in thickness, which corresponds with depth to sandstone. The A1 or Ap horizon is very dark grayish brown or dark brown. It is less than 15 percent sandstone fragments. It ranges from medium acid to strongly acid except in areas that are limed. The B horizon is dark brown, brown, dark yellowish brown, yellowish brown, or strong brown. In most profiles it has brownish, yellowish, or reddish mottles. In some profiles the B horizon has gray mottles in the lower part. The B horizon is loam, sandy clay loam, or clay loam. It ranges from slightly acid to strongly acid.

1—Bates fine sandy loam, 1 to 3 percent slopes. This soil is very gently sloping. Included in mapping are about 5 percent Dennis soils, 10 percent Fitzhugh soils, and 5 percent small areas of eroded soils that are similar to this Bates soil but that have a thinner surface layer.

This soil is used mostly for grain sorghum, soybeans, wheat, peanuts, and cotton. Tame pasture plants are grown in some areas.

The main concerns of management are controlling erosion and maintaining soil tilth and fertility.

Cropping systems that provide for the return of adequate amounts of residue to the soil are needed. Erosion can be reduced by contour farming with terraces and managing crop residue. Plant cover is needed in winter and spring to help prevent erosion. Use of plant food increases plant growth and provides additional crop residue for erosion control. Terracing, contour farming, and using cover crops are especially needed where crops are grown. Capability unit IIe-1; Loamy Prairie range site; not assigned to woodland group.

Bernow Series

The Bernow series consists of very gently sloping to strongly sloping soils on uplands. These soils formed in material weathered from sandy and loamy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is dark brown fine sandy loam 7 inches thick. The subsurface layer is yellowish brown fine sandy loam 8 inches thick. The upper part of the subsoil is strong brown sandy clay loam 33 inches thick, and the lower part is mottled yellowish brown and strong brown sandy clay loam and light gray fine sandy loam 20 inches thick.

Bernow soils are well drained and have moderate permeability. Available water capacity is high. In most years a water table is at a depth of more than 6 feet.

Representative profile of Bernow fine sandy loam, 8 to 12 percent slopes, 1,200 feet east and 60 feet north of the southwest corner of sec. 20, T. 6 S., R. 12 E.:

A1—0 to 7 inches; dark brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; hard, friable; neutral; clear smooth boundary.

A2—7 to 15 inches; yellowish brown (10YR 5/4) fine sandy loam, light yellowish brown (10YR 6/4) dry; weak fine granular structure; hard, friable; neutral; clear smooth boundary.

B21t—15 to 38 inches; strong brown (7.5YR 5/6) sandy clay loam, reddish yellow (7.5YR 6/6) dry; few fine

[1]United States Department of Agriculture. 1951. Soil survey manual. U.S. Dept. Agr. Handbook No. 18, 503 pp., illus.

TABLE 3.—*Acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent
1	Bates fine sandy loam, 1 to 3 percent slopes	1,920	0.3
2	Bernow loamy fine sand, 3 to 8 percent slopes	1,770	0.3
3	Bernow fine sandy loam, 1 to 3 percent slopes	7,010	1.2
4	Bernow fine sandy loam, 3 to 5 percent slopes	18,145	3.1
5	Bernow fine sandy loam, 5 to 8 percent slopes	2,660	0.4
6	Bernow fine sandy loam, 8 to 12 percent slopes	28,750	4.8
7	Bernow-Bosville complex, 2 to 5 percent slopes, eroded	10,645	1.8
8	Bernow-Romia complex, 3 to 8 percent slopes	10,780	1.8
9	Bernow-Romia complex, 8 to 20 percent slopes	13,345	2.2
10	Bernow soils, 2 to 8 percent slopes, severely eroded	4,700	0.8
11	Bosville fine sandy loam, 2 to 5 percent slopes	6,210	1.0
12	Bosville fine sandy loam, 5 to 8 percent slopes	2,975	0.5
13	Boxville fine sandy loam, 1 to 3 percent slopes	6,155	1.0
14	Boxville fine sandy loam, 3 to 8 percent slopes	13,785	2.3
15	Burleson clay, 0 to 1 percent slopes	5,900	1.0
16	Burleson clay, 1 to 3 percent slopes	22,095	3.7
17	Burleson clay, 3 to 5 percent slopes	3,935	0.7
18	Catoosa-Claremore complex, 1 to 3 percent slopes	3,440	0.6
19	Collinsville fine sandy loam, 3 to 12 percent slopes	765	0.1
20	Crockett loam, 1 to 3 percent slopes	1,715	0.3
21	Crockett-Durant complex, 1 to 5 percent slopes, eroded	24,315	4.1
22	Crockett soils, 1 to 6 percent slopes, severely eroded	770	0.1
23	Dennis loam, 0 to 1 percent slopes	2,610	0.4
24	Dennis loam, 1 to 3 percent slopes	27,600	4.6
25	Dennis loam, 3 to 5 percent slopes	12,570	2.1
26	Durant loam, 1 to 3 percent slopes	47,020	7.9
27	Durant loam, 3 to 5 percent slopes	6,050	1.0
28	Durant-Verdigris complex	13,360	2.2
29	Eufaula fine sand, 3 to 15 percent slopes	925	0.2
30	Ferris clay, 1 to 5 percent slopes, eroded	7,105	1.2
31	Ferris clay, 8 to 20 percent slopes	1,925	0.3
32	Ferris-Romia complex, 5 to 20 percent slopes	3,715	0.6
33	Ferris-Tarrant complex, 8 to 20 percent slopes	19,480	3.3
34	Fitzhugh fine sandy loam, 3 to 5 percent slopes	2,165	0.4
35	Fitzhugh-Bates complex, 1 to 5 percent slopes, eroded	10,795	1.8
36	Freestone fine sandy loam, 1 to 5 percent slopes	1,845	0.3
37	Frioton silty clay loam	10,385	1.7
38	Gowton loam	13,530	2.3
39	Guyton silt loam	1,150	0.2
40	Heiden clay, 3 to 5 percent slopes	4,350	0.7
41	Heiden stony soils, 2 to 5 percent slopes	1,945	0.3
42	Karma fine sandy loam, 1 to 3 percent slopes	8,270	1.4
43	Karma fine sandy loam, 3 to 5 percent slopes	2,295	0.4
44	Karma fine sandy loam, 2 to 5 percent slopes, eroded	2,470	0.4
45	Karma fine sandy loam, 8 to 20 percent slopes	2,870	0.5
46	Kaufman clay	9,740	1.6
47	Kaufman clay, depressional	3,260	0.5
48	Kiomatia fine sandy loam	4,405	0.7
49	Kiomatia complex	2,195	0.4
50	Kiomatia soils	3,430	0.6
51	Larton loamy fine sand, 1 to 3 percent slopes	6,235	1.1
52	Larton loamy fine sand, 3 to 5 percent slopes	2,385	0.4
53	Larue loamy fine sand, 0 to 3 percent slopes	5,660	1.0
54	Madill fine sandy loam	6,300	1.1
55	Matoy silty clay loam, 1 to 3 percent slopes	6,295	1.1
56	Muldrow silty clay loam	3,650	0.6
57	Muskogee silt loam, 0 to 1 percent slopes	4,525	0.8
58	Muskogee silt loam, 1 to 3 percent slopes	15,610	2.6
59	Muskogee silt loam, 3 to 5 percent slopes	4,070	0.7
60	Muskogee silt loam, 2 to 5 percent slopes, eroded	4,180	0.7
61	Norwood silt loam	5,260	0.9
62	Okay fine sandy loam, 0 to 1 percent slopes	4,935	0.8
63	Okay loam, 0 to 1 percent slopes	4,495	0.8
64	Okay loam, 1 to 3 percent slopes	1,380	0.2
65	Oklared fine sandy loam	2,915	0.5
66	Oklared silty clay loam	3,070	0.5
67	Parsons silt loam, 0 to 1 percent slopes	10,170	1.7
68	Pits	825	0.1
69	Pledger clay	985	0.2
70	Redport silty clay loam	4,000	0.7
71	San Saba-Tarrant complex, 1 to 8 percent slopes	5,365	0.9
72	Severn fine sandy loam	2,860	0.5
73	Ships clay	4,450	0.8
74	Ships clay, depressional	2,260	0.4
75	Tarrant soils, 1 to 8 percent slopes	2,365	0.4
76	Trinity clay	4,025	0.7
77	Tullahassee fine sandy loam	4,460	0.8
78	Verdigris silty clay loam	18,830	3.2
79	Woodson silt loam, 0 to 1 percent slopes	5,995	1.0
80	Woodtell loam, 2 to 5 percent slopes	2,160	0.4
	Water area	25,600	4.3
	Total	594,560	100.0

distinct yellowish red mottles; moderate medium subangular blocky structure; very hard, firm; few thin discontinuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—38 to 48 inches; strong brown (7.5YR 5/6) sandy clay loam, reddish yellow (7.5YR 6/6) dry; common medium distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; few thin discontinuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B2t&A'2—48 to 68 inches; coarsely mottled yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) (B part) sandy clay loam; weak coarse subangular blocky structure; very hard, firm; 10 percent light

gray (10YR 6/1) fine sandy loam (A part); massive; very friable; slightly hard; few thin discontinuous clay films bridging sand grains; few fine dark concretions; strongly acid.

The profile is 60 inches to more than 80 inches thick. The A1 or Ap horizon is very dark grayish brown, dark grayish brown, grayish brown, brown, or dark brown. It is a fine sandy loam or loamy fine sand. Reaction generally ranges from slightly acid to medium acid, but it is neutral where these soils are limed. The A2 horizon is pale brown, brown, yellowish brown, light yellowish brown, reddish yellow, or light brown. It is fine sandy loam or loamy fine sand. The A2 horizon generally ranges from strongly acid to slightly acid, but it is neutral where these soils are limed. The B2t horizon is yellowish brown, light yellowish brown, brownish yellow, strong brown, reddish yellow, yellowish red, and reddish brown. In most profiles it has reddish or brownish mottles, and in some profiles mottles are grayish at a depth of more than 30 inches. The B2t horizon is loam, clay loam, or sandy clay loam. It ranges from very strongly acid to medium acid. The B part of the B2t&A'2 horizon is coarsely mottled in shades of red, yellow, brown, or gray. The A part makes up 5 to 15 percent of the matrix and occurs as pockets, vertical streaks, or ped coatings. It is light gray, light brownish gray, white, pinkish gray, pinkish white. The B2t&A'2 horizon ranges from strongly acid to very strongly acid.

2—Bernow loamy fine sand, 3 to 8 percent slopes. This soil is gently sloping to sloping. It has a profile similar to that described as representative for the series, but the surface layer is loamy fine sand. Included in mapping and making up 30 percent of the mapped area are areas of soils that have a profile that is similar to this Bernow soil, but the combined thickness of the surface layer and subsurface layer is 20 to 24 inches.

This soil is used mostly for tame pasture. Sizable areas are managed for woodland. The main cultivated crops are grain sorghum, peanuts, wheat, and soybeans.

The main concerns of management are controlling erosion and maintaining soil fertility. Most crops that produce large amounts of plant residue can be grown continuously where the residue is returned to the soil. Plant food increases plant growth and provides more plant residue to reduce soil blowing. In areas that are row cropped, stripcropping and planting winter cover crops furnish additional soil protection. Crops that provide small amounts of plant residue should not be grown 2 years in succesion. Capability unit IVe-1; not assigned to range site; woodland group 4o.

3—Bernow fine sandy loam, 1 to 3 percent slopes. This soil is very gently sloping. It has a profile similar to the one described as representative for the series, but the combined thickness of the surface layer and subsurface layer is about 17 inches. Included in mapping are about 10 percent Bosville soils, about 5 percent soils that are similar to this Bernow soil but that have gray mottling within 30 inches of the surface, and about 5 percent eroded soils that are similar to this Bernow soil but that have a surface layer and subsurface layer about 6 inches thick combined.

This soil is used mostly for peanuts, grain sorghum, soybeans, wheat, or cotton. A sizable acreage is used for tame pasture and woodland.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Terracing is an optional practice, but it needs to be used where the soil is eroded. Plant food increases plant growth and provides more crop residue to help maintain tilth and fertility. Contour farming in sloping areas, stripcropping, and using crop residue help to control erosion. Minimum tillage needs to be used. Capability unit IIe-2; not assigned to range site; woodland group 4o.

4—Bernow fine sandy loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to that described as representative for the series, but the combined thickness of the surface layer and subsurface layer is about 17 inches. Included in mapping are less than 10 percent Bosville soils, 5 percent eroded soils that are similar to this Bernow soil but that have gray mottles within 30 inches of the surface, and less than 5 percent soils that are similar to this Bernow soil but that have a surface layer about 6 inches thick.

This soil is used mostly for tame pasture, wheat, grain sorghum, peanuts, soybeans, and cotton. A small acreage is used for woodland.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Large amounts of crop residue need to be returned to the soil and plant food added to help maintain tilth and fertility. High-residue crops such as wheat need to be dominant in the cropping system where row crops are grown. Terracing, contour farming, and using crop residue help to control erosion. Capability unit IIIe-4; not assigned to range site; woodland group 4o.

5—Bernow fine sandy loam, 5 to 8 percent slopes. This soil is sloping. It has a profile similar to that described as representative for the series, but the combined thickness of the surface layer and subsoil is about 16 inches. Included in mapping are 10 percent Bosville soils and 5 percent soils that have a profile similar to that described as representative for the Bernow series but that have gray mottles within 30 inches of the surface.

This soil is used mostly for tame pasture. A sizable acreage is managed for woodland. The main cultivated crop is wheat.

The main concerns of management are providing protection from soil blowing and erosion and maintaining tilth and fertility. A cropping system that uses mostly small grain and enough plant food to produce maximum residue is needed to control erosion. Row crops should be avoided to prevent excessive erosion. Terraces, waterways, and contour farming are other practices that protect the soil. Planting tame pasture grasses and legumes and adding plant food reduce erosion. Capability unit IVe-2; not assigned to range site; woodland group 4o.

6—Bernow fine sandy loam, 8 to 12 percent slopes. This soil is moderately steep to strongly sloping. It has a profile described as representative of the series. Included in mapping are about 5 percent Bosville soils, about 10 percent Romia soil, and about 10 percent soils that have a profile similar to that described as representative for the series, but depth to sandstone is less than 60 inches.

This soil is used mostly for native grass or woodland. Some areas are used for tame pasture grasses.

The main concerns of management are preventing erosion and maintaining tilth. Proper management of native grasses, woodlands, and tame pasture maintains tilth and reduces erosion. Proper grazing, controlling brush, and protecting the soil from fire improve the quality and yields of native grasses. The wooded areas can be improved by removing or controlling inferior species, planting suitable species, selective harvesting of trees on a planned schedule, and protecting the areas from fire. Plant food and proper grazing improve tame pasture and help to control erosion. Capability unit VIe-3; not assigned to range site; woodland group 4o.

7—Bernow-Bosville complex, 2 to 5 percent slopes, eroded. These soils are very gently sloping to gently sloping and are eroded. The Bernow and Bosville soils are in such an intricate pattern that it is impractical to map each separately. Bernow soils are on upper side slopes, and Bosville soils are on lower side slopes. These soils have a profile similar to that described as representative for their respective series, but the surface layer is about 7 inches thick and is mixed with material from the subsoil in about 40 percent of the area. Shallow gullies and a few deep gullies occur 150 to 400 feet apart. Rills caused by erosion are common throughout the area. About 50 percent of this complex is Bernow fine sandy loam, 30 percent is Bosville fine sandy loam, 5 percent is Muskogee soils, and 15 percent is soils that are similar to these Bernow and Bosville soils but that have a surface layer of loam, clay loam, sandy clay loam, or clay.

Bernow and Bosville soils are used mostly for tame pasture. The main cultivated crop is wheat.

The main concerns of management are maintaining tilth and fertility and protecting the soil from erosion. A cropping system using small grain and enough plant food to produce maximum residue is needed to control further erosion. Terraces, waterways, and contour farming are necessary to reduce the rate of erosion. In a few areas, gullies need to be shaped and planted to permanent vegetation. Row crops should be avoided to prevent excessive erosion. Planting native grasses or tame pasture grasses and legumes and adding plant food help to reduce erosion. Capability unit IIIe-5; not assigned to range site; Bernow part in woodland group 4o; Bosville part in woodland group 4c.

8—Bernow-Romia complex, 3 to 8 percent slopes. These soils are gently sloping to sloping. The Bernow and Romia soils are in such an intricate pattern that it is impractical to map each separately. The Romia soils are on ridge crests, and the Bernow soils are on lower side slopes. These soils have a profile similar to that described as representative for their respective series, but the surface layer is loamy fine sand. About 60 percent of this complex is Bernow loamy fine sand, 25 percent is Romia loamy fine sand, 5 percent is Bosville soils, and 10 percent is soils that have a profile similar to that described as representative for the Romia series, but depth to sandstone is less than 40 inches or the combined thickness of the surface layer and subsurface layer is more than 20 inches.

These soils are used mostly for tame pasture. Sizable areas are managed for woodland. The main cultivated crops are grain sorghum, peanuts, wheat, and soybeans.

The main concerns of management are controlling erosion and maintaining fertility. Most crops that produce large amounts of plant residue can be grown continuously where the residue is returned to the soil. Adding plant food increases plant growth and provides more residue to reduce soil blowing. In areas that are row cropped, stripcropping and planting winter cover crops furnish additional soil protection. Crops that provide small amounts of plant residue should not be grown 2 years in succession. Capability unit IVe-1; Bernow part not assigned to range site; Romia part in Sandy Savannah range site; Bernow part in woodland group 4o; Romia part in woodland group 4f.

9—Bernow-Romia complex, 8 to 20 percent slopes. These soils are strongly sloping to moderately steep. The Bernow and Romia soils are in such an intricate pattern that it is impractical to map them separately. Bernow soils are on upper side slopes, and Romia soils are on lower side slopes. A Bernow soil in this complex has a profile similar to that described as representative for the Bernow series, but the surface layer is loamy fine sand. A Romia soil in this complex has the profile described as representative for the Romia series. About 60 percent of this complex is Bernow loamy fine sand, 25 percent is Romia cobbly loamy fine sand, 5 percent is Muskogee and Bosville soils, and 10 percent is soils that are similar to these Bernow and Romia soils but that have a surface layer and subsurface layer more than 20 inches thick combined or depth to sandstone is less than 40 inches.

These soils are used for native grass and woodland. A few areas are in tame pasture.

The main concerns of management are controlling erosion and maintaining tilth. The quality of native grasses can be maintained or improved by controlling brush, using suitable grazing practices, and protecting the areas from fire. The wooded areas that have desirable trees can be improved by protecting them from fire, planting suitable species, removing or controlling inferior species, and selectively harvesting trees on a planned schedule. The quality of tame pasture can be improved by controlling brush, applying plant food, and using suitable grazing practices. Capability unit VIe-2; Bernow part not assigned to range site; Romia part in Sandy Savannah range site; Bernow part in woodland group 4o; Romia part in woodland group 4f.

10—Bernow soils, 2 to 8 percent slopes, severely eroded. These soils are very gently sloping to sloping. They have a profile similar to that described as representative for the series, but part of the original surface layer has been removed by erosion in about 70 percent of the areas. In these areas the surface layer is a mixture of fine sandy loam, loam, sandy clay loam, and clay loam. About 20 percent of the acreage has shallow rills and gullies. Gullies more than 3 feet deep are at intervals of 80 to 250 feet. Areas of soil deposition are below the largest gullies. Included with these soils in mapping are areas of Bosville and Karma soils that

make up less than 15 percent of the mapped acreage.

These soils are used mostly for tame pasture. Some areas are used for native grasses or trees.

The main concerns of management are controlling the severe hazard of erosion and maintaining tilth and fertility. Cultivated areas need to be returned to such permanent vegetation as tame pasture, native grasses, or trees to reduce erosion. Adding plant food, diverting overhead water, and shaping gully banks are needed for the establishment of tame pasture. The quality and quantity of tame pasture plants can be improved by proper grazing, controlling weeds or brush, and adding plant food. Areas suitable for trees can be planted to loblolly pine, shortleaf pine, or southern red oak. The quality of trees can be improved by protecting the areas from fire, by thinning, and by selectively harvesting on a planned schedule. Capability unit VIe-5; not assigned to range site; woodland group 4o.

Bosville Series

The Bosville series consists of very gently sloping to sloping soils on uplands. These soils formed in material weathered from loamy and clayey sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is very dark grayish brown fine sandy loam 1 inch thick. The subsurface layer is dark brown fine sandy loam 3 inches thick. The upper part of the subsoil is red silty clay loam 21 inches thick; the middle part is red clay 19 inches thick; and the lower part is red clay loam 26 inches thick.

Bosville soils are moderately well drained and have very slow permeability. Available water capacity is medium. These soils have a water table at a depth of 1 to 2 feet during February through June.

Representative profile of Bosville fine sandy loam, 2 to 5 percent slopes, 1,320 feet west and 1,890 feet south of the northeast corner of sec. 22, T. 6 S., R. 12 E.:

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, very friable; many fine roots; few fine pebbles; medium acid; clear smooth boundary.

A2—1 inch to 4 inches; dark brown (7.5YR 4/4) fine sandy loam, brown (7.5YR 5/4) dry; moderate fine granular structure; slightly hard, very friable; many fine roots; few fine pebbles; medium acid; abrupt wavy boundary.

B21t—4 to 15 inches; red (2.5YR 4/6) silty clay loam, red (2.5YR 5/6) dry; strong fine and medium blocky structure; very hard, firm; many fine and medium roots; few cracks filled with dark brown (10YR 4/3) fine sandy loam; thick patchy clay films on faces of peds; few dark stains; very strongly acid; gradual smooth boundary.

B22t—15 to 25 inches; red (2.5YR 4/6) silty clay loam, red (2.5YR 5/6) dry; common medium prominent light yellowish brown (10YR 6/4) mottles; strong fine and medium blocky structure; very hard, firm; few fine roots; few cracks filled with dark brown (10YR 4/3) fine sandy loam; thick patchy continuous clay films on faces of peds; few dark stains; very strongly acid; clear smooth boundary.

B23t—25 to 44 inches; red (2.5YR 4/6) clay, red (2.5YR 5/6) dry; common medium prominent pale brown (10YR 6/3) and light brownish gray (2.5Y 6/2) mottles; strong medium blocky structure; very hard, firm; few fine roots; thick patchy clay films on faces of peds; few slickensides that do not intersect; very strongly acid; gradual wavy boundary.

B24t—44 to 54 inches; red (2.5YR 4/6) clay loam, red (2.5YR 5/6) dry; common medium and coarse prominent light brownish gray (10YR 6/2; 2.5Y 6/2) and light yellowish brown (2.5Y 6/4) mottles; moderate medium blocky structure; very hard, firm; few fine roots; thin patchy clay films on faces of peds; few pockets of uncoated sand grains; strongly acid; gradual wavy boundary.

B3—54 to 70 inches; red (2.5YR 4/6) clay loam, red (2.5YR 5/6) dry; common coarse prominent brownish yellow (10YR 6/6) and light gray (10YR 6/1) mottles; weak coarse blocky structure; very hard, very firm; few fine roots; thin patchy clay films on faces of peds; few pockets of uncoated sand grains; strongly acid.

The profile ranges from 60 to more than 80 inches in thickness. The A1 or Ap horizon is very dark grayish brown, dark brown, or dark grayish brown. The A2 horizon is grayish brown, brown, or dark brown, yellowish brown, strong brown, light brownish gray, pinkish gray, pale brown, light brown, light yellowish brown, brownish yellow, and reddish yellow. The A horizon ranges from medium acid to strongly acid, except where limed.

The B21t horizon is red, strong brown, reddish brown, reddish yellow, or yellowish red. It is clay loam, silty clay loam, silty clay, or clay. Reaction ranges from strongly acid to very strongly acid. Some profiles have grayish mottles below the upper 10 inches of the B21t horizon. The B22t, B23t, B24t, and B3 horizons are red. strong brown, reddish brown, reddish yellow, or yellowish red clay loam, silty clay loam, silty clay, or clay. They are mottled in shades of gray, brown, or yellow. Reaction ranges from medium acid to very strongly acid.

11—Bosville fine sandy loam, 2 to 5 percent slopes. This soil is very gently sloping to gently sloping. It has a profile described as representative of the series. Included with this soil in mapping are less than 10 percent Bernow soils and less than 10 percent areas of an eroded soil that has a profile similar to that described for the Bosville series, but in which the surface layer is a sandy clay loam, clay loam, or clay.

This soil is used mostly for tame pasture. A sizable acreage is managed for woodland. The main cultivated crop is wheat.

The main concerns of management are protecting the soil from soil blowing and water erosion and maintaining tilth and fertility. A cropping system that mainly includes small grains and amounts of plant food that provide for maximum residue is needed to control erosion. Row crops should be avoided to prevent excessive erosion. Terraces, waterways, and contour farming are additional practices used to protect the soil. Planting tame pasture grasses and legumes and adding plant food reduce erosion. Capability unit IVe-2; not assigned to range site; woodland group 4c.

12—Bosville fine sandy loam, 5 to 8 percent slopes. This soil is sloping. It has a profile similar to that described as representative for the series, but the surface layer and subsurface layer are about 6 inches thick. Included with this soil in mapping are areas of Bernow soils, which make up less than 10 percent of the mapped acreage, and areas of Romia soils, which make up less than 5 percent.

This soil is used mostly for native grass or wood-

land. Some areas are used for tame pasture grasses.

The main concerns of management are preventing erosion and maintaining tilth. Proper management of native grasses, woodlands, and tame pasture plants will maintain tilth and reduce erosion. Preventing overgrazing, controlling brush, and protecting the soil from fire will improve the quality and yield of native grasses. The wooded areas can be improved by removing or controlling inferior species, planting suitable species, selectively harvesting trees on a planned schedule, and protecting the areas from fire. Adding plant food and preventing overgrazing improve tame pasture plants and help to control erosion. Capability unit VIe-3; not assigned to range site; woodland group 4c.

Boxville Series

The Boxville series consists of very gently sloping to sloping soils on uplands. These soils formed in material weathered from loamy and clayey sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is dark brown fine sandy loam 8 inches thick. The upper part of the subsoil is red clay 49 inches thick, and the lower part is red shaly silty clay 13 inches thick.

The Boxville soils are well drained and have slow permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Boxville fine sandy loam, 3 to 8 percent slopes, 2,200 feet east and 20 feet north of the southwest corner of sec. 15, T. 9 S., R. 9 E.:

Ap—0 to 8 inches; dark brown (10YR 4/3) fine sandy loam, brown (10YR 5/3) dry; moderate fine granular structure; hard, friable; many fine roots; medium acid; abrupt wavy boundary.

B21t—8 to 19 inches; red (2.5YR 4/6) clay, red (2.5YR 5/6) dry; moderate fine blocky and subangular blocky structure; very hard, very firm; common fine roots; common shiny surfaces on faces of peds; strongly acid; gradual smooth boundary.

B22t—19 to 35 inches; red (2.5YR 4/6) clay, red (2.5YR 5/6) dry; moderate fine blocky structure; very hard, very firm; few fine roots; common manganese and iron concretions; common shiny surfaces on faces of peds; common slickensides and few intersecting slickensides; slightly acid; gradual smooth boundary.

B23t—35 to 57 inches; red (2.5YR 4/6) clay, red (2.5YR 5/6) dry; moderate fine blocky structure; very hard, very firm; few fine roots; few shiny surfaces on faces of peds; few manganese and iron concretions; few calcium carbonate concretions; calcareous in seams below a depth of 44 inches; neutral; gradual smooth boundary.

B3—57 to 70 inches; red (2.5YR 4/6) shaly silty clay, red (2.5YR 5/6) dry; few fine prominent gray mottles in lower part; weak medium blocky structure; very hard, very firm; few iron and manganese concretions; few calcium carbonate concretions; calcareous; moderately alkaline.

Depth to bedrock is more than 60 inches. Soft carbonates are at a depth of 36 inches to more than 80 inches. The Ap or A1 horizon is very dark grayish brown, dark brown or brown, grayish brown, or reddish brown. It ranges from strongly acid to slightly acid.

The B2t horizon is reddish brown, yellowish red, red, or dark red. Grayish mottles occur below a depth of 30 inches in some profiles. The B2t horizon is silty clay loam, clay loam, silty clay, or clay. The B21t and B22t horizons range from very strongly acid to slightly acid. The B23t horizon ranges from medium acid to moderately alkaline. Intersecting slickensides are lacking in some pedons. The B3 horizon is yellowish red, red, or dark red. It is shaly silty clay, clay, or clay loam and ranges from medium acid to moderately alkaline.

13—Boxville fine sandy loam, 1 to 3 percent slopes. This soil is very gently sloping. It has a profile similar to that described as representative for the series, but the surface layer is 9 inches thick. Included with this soil in mapping are about 5 percent Bosville soils, 5 percent Karma soils, and 5 percent areas of a soil that has a profile similar to that described as representative for the Boxville series, but in which the surface layer is loam or clay loam and the soil is eroded.

This soil is used mostly for tame pasture, wheat, grain sorghum, peanuts, soybeans, and cotton. A small acreage is used for woodland.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Large amounts of crop residue need to be returned to the soil and plant food added to help to maintain tilth and fertility. High-residue crops such as wheat need to be dominant in the cropping system where row crops are grown. Terracing, contour farming, and using crop residue help to control erosion. Capability unit IIIe-4; Loamy Savannah range site; woodland group 4o.

14—Boxville fine sandy loam, 3 to 8 percent slopes. This soil is gently sloping to sloping. It has a profile described as representative of the series. Included with this soil in mapping and making up about 10 percent of the area are areas of Karma, Bosville, and Bernow soils. Also included and making up 10 percent of the area is a soil that has a profile similar to that described as representative for the Boxville series, but in which the surface layer is a mixture of fine sandy loam, clay loam, and clay.

This soil is used mostly for tame pasture. A sizable acreage is managed for woodland. The main cultivated crop is wheat.

The main concerns in management are protecting the soil from soil blowing and water erosion and maintaining tilth and fertility. A cropping system that mainly includes small grains and amounts of plant food that provide for maximum residue is needed to control erosion. Row crops should be avoided to prevent excessive erosion. Using terraces, waterways, and contour farming also helps to protect the soil. Growing tame pasture grasses and legumes and adding plant food reduce erosion. Capability unit IVe-2; Loamy Savannah range site; woodland group 4o.

Burleson Series

The Burleson series consists of nearly level to gently sloping soils on uplands. These soils formed in material weathered from clayey sediment under a cover of grasses.

In a representative profile the surface layer is black clay 16 inches thick. The next layer is very dark gray clay 25 inches thick. Below this is very dark grayish brown clay 8 inches thick. The next layer is dark grayish brown clay to a depth of 60 inches.

Burleson soils are moderately well drained and have very slow permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Burleson clay, 0 to 1 percent slopes, 315 feet south and 60 feet east of the northwest corner of sec. 10, T. 5 S., R. 9 E.:

A1—0 to 16 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine blocky structure; very hard, firm; many fine roots; some shiny faces on peds; noncalcareous; mildly alkaline; gradual wavy boundary.

AC1—16 to 41 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine blocky structure; very hard, very firm; intersecting slickensides and parallelepipeds tilted about 40°; at a depth of more than 20 inches; common roots; shiny faces on peds; noncalcareous; mildly alkaline; gradual wavy boundary.

AC2—41 to 49 inches; very dark grayish brown (2.5Y 3/2) clay, dark grayish brown (2.5Y 4/2) dry; moderate fine blocky structure; extremely hard, very firm; intersecting slickensides and parallelepipeds tilted about 40°; few roots; shiny pressure faces on peds; some streaks of darker material from AC1 horizon; few calcium carbonate concretions; few fine iron and manganese concretions; noncalcareous in mass except for some seams; moderately alkaline; gradual wavy boundary.

AC3—49 to 60 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (2.5Y 5/2) dry; weak and moderate medium blocky structure; hard, very firm; intersecting slickensides and parallelepipeds tilted about 40°; few roots; some streaks of darker material from upper parts of the A horizon; shiny faces on peds; common fine calcium carbonate concretions; few fine manganese and iron concretions; calcareous; moderately alkaline.

Depth to bedrock is more than 60 inches. The profile is more than 40 inches thick, and it cracks when dry. Intersecting slickensides are below a depth of 20 inches. The A1 or Ap horizon is black, dark gray, or very dark gray. It ranges from slightly acid to mildly alkaline. The AC horizon is dark gray or very dark gray above a depth of 40 inches. In the lower part it is very dark grayish brown, dark grayish brown, olive gray, or olive. The AC horizon has few or common brownish, yellowish, or olive mottles. It is noncalcareous or calcareous and ranges from mildly alkaline to moderately alkaline.

15—Burleson clay, 0 to 1 percent slopes. This soil is nearly level. It has a profile described as representative of the series. Included in mapping and making up 20 percent of the acreage is a soil that has a profile similar to that described as representative for the Burleson series, but in which the surface layer is calcareous or the lower part of the profile is light olive brown or olive brown.

This soil is used mostly for cotton, grain sorghum, soybeans, wheat, and tame pasture. A few small areas are in native grass.

The main concerns of management are maintaining tilth and water intake and controlling surface wetness, erosion on long slopes, and surface crusting. Crops that produce large amounts of residue are needed in the cropping system. Additions of plant food to produce crop residue increase the content of organic matter, maintain tilth, improve water intake, and prevent surface crusting. A drainage system coupled with arranging rows for drainage reduces surface wetness and improves crop yields. In a few areas, diversion terraces on long slopes can be used to reduce erosion. Tillage should be timely and kept to a minimum. Capability unit IIw-3; Blackclay Prairie range site; not assigned to a woodland group.

16—Burleson clay, 1 to 3 percent slopes. This soil is very gently sloping. It has a profile similar to that described as representative for the series, but it is calcareous below a depth of 41 inches. Included with this soil in mapping and making up 20 percent of the area is a soil that has a profile similar to that described as representative for the series, but in which the surface layer is calcareous or the lower part of the profile is light olive brown or olive brown.

This soil is used mostly for cotton, grain sorghum, soybeans, wheat, and tame pasture. A few areas are in native grass (fig. 1).

The main concerns of management are controlling erosion and surface crusting, increasing water intake, and maintaining tilth. The cropping system should include crops that produce large amounts of crop residue. Low-residue crops such as cotton need to be rotated with high-residue crops about one-half of the time. Additions of plant food to produce crop residue maintain organic matter, improve tilth, increase water intake, and prevent surface crusting. Terracing, contour farming, and using cover crops are especially needed where row crops are grown. Capability unit IIe-3; Blackclay Prairie range site; not assigned to a woodland group.

17—Burleson clay, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to that described as representative for the series, but it is calcareous at a depth of 42 inches. Included with this soil in mapping are areas of Heiden soils, which make up less than 10 percent of the mapped acreage, and areas of Ferris soils, which make up less than 5 percent. Also included with this soil and making up 20 percent of the mapped area is a soil that has a profile similar to that described as representative for the Burleson series, but in which the lower part of the profile is light olive brown or olive brown.

This soil is used for grain sorghum, wheat, cotton, and tame pasture. A few areas are managed for native grass.

The main concerns of management are controlling erosion and surface crusting, increasing water intake, and maintaining tilth. Crops that produce large amounts of residue need to be used in the cropping system. Terracing, contour farming, and using cover crops help to control erosion. The addition of plant food that provides for maximum crop residue increases the content of organic matter, increases water intake, maintains tilth, and prevents surface crusting. Tillage needs to be timely and kept to a minimum. Capability unit IIIe-3; Blackclay Prairie range site; not assigned to a woodland group.

Catoosa Series

The Catoosa series consists of very gently sloping soils on uplands. These soils formed in loamy material weathered from limestone under a cover of grasses.

In a representative profile the surface layer is dark

Figure 1.—Native grass on Burleson clay, 1 to 3 percent slopes.

reddish brown silt loam 8 inches thick. The upper part of the subsoil is dark reddish brown silty clay loam 4 inches thick, and the lower part is dark red silty clay loam 10 inches thick. Below this is hard limestone bedrock that is not rippable.

Catoosa soils are well drained and have moderate permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Catoosa silt loam in an area of Catoosa-Claremore complex, 1 to 3 percent slopes, 2,640 feet north and 460 feet west of the southeast corner of sec. 5, T. 5 S., R. 12 E.:

Ap—0 to 8 inches; dark reddish brown (5YR 3/3) silt loam, reddish brown (5YR 4/3) dry; moderate fine and very fine granular structure; hard, very friable; slightly acid; gradual smooth boundary.

B1—8 to 12 inches; dark reddish brown (5YR 3/4) silty clay loam, reddish brown (5YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, friable; patchy clay films, few small black concretions; medium acid; gradual smooth boundary.

B2t—12 to 22 inches; dark red (2.5YR 3/6) silty clay loam, red (2.5YR 4/6) dry; moderate medium subangular blocky structure; hard, firm; thin continuous clay films on faces of peds; few small black concretions; medium acid; abrupt wavy boundary.

R—22 to 26 inches; hard limestone bedrock with fractures 1 to 5 feet apart filled with dark red (2.5YR 3/6) silty clay loam in the upper part.

The profile is 20 to 40 inches thick over limestone. The A1 or Ap horizon is very dark grayish brown, dark brown, or dark reddish brown. It ranges from slightly acid to medium acid.

The B1 horizon is dark brown, dark reddish brown, reddish brown or dark reddish gray. It is a silt loam or silty clay loam and ranges from slightly acid to medium acid. The B2t horizon is dark brown, dark reddish brown, reddish brown, yellowish red, dark red, or red. It is silty clay loam or clay loam and ranges from medium acid to neutral. Limestone fragments make up less than 3 percent of the profile.

18—Catoosa-Claremore complex, 1 to 3 percent slopes. These soils are very gently sloping. The Catoosa and Claremore soils are in such an intricate pattern that it is impractical to map each soil separately. They have profiles described as representative of their respective series. Catoosa soils are on side slopes, and Claremore soils are on crests. About 60 percent of the acreage in this complex is Catoosa silt loam, and about 30 percent is Claremore silt loam. The rest is a soil that has a profile similar to that described as representative for the Claremore series, but in which the sur-

face layer is about 4 inches thick and depth to limestone is less than 10 inches.

These soils are used mostly for grain sorghum, soybeans, wheat, peanuts, and cotton. Tame pasture plants are grown in some areas.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Cropping systems need to provide for the return of adequate amounts of residue to the soil. Erosion can be reduced by contour farming with terraces and by managing crop residue. Plant cover is needed during winter and spring to help to prevent erosion. Using plant food increases plant growth and provides additional crop residue for erosion control. Terracing, contour farming, and using cover crops are especially necessary if row crops are grown. Capability unit IIe-1; Loamy Prairie range site; not assigned to a woodland group.

Claremore Series

The Claremore series consists of very gently sloping soils on uplands. These soils formed in loamy material weathered from limestone under a cover of grasses.

In a representative profile the surface layer is dark reddish brown silt loam 8 inches thick. The upper part of the subsoil is dark reddish brown silty clay loam 3 inches thick, and the lower part is dark red silty clay loam 7 inches thick. Below this is hard limestone bedrock that is not rippable.

Claremore soils are well drained and have moderate permeability. Available water capacity is low. The water table is at a depth of more than 6 feet.

Representative profile of Claremore silt loam in an area of Catoosa-Claremore complex, 1 to 3 percent slopes, 2,600 feet north and 320 feet west of the southeast corner of sec. 5, T. 5 S., R. 12 E.:

Ap—0 to 8 inches; dark reddish brown (5YR 3/3) silt loam, reddish brown (5YR 4/3) dry; moderate fine granular structure; hard, very friable; slightly acid; gradual smooth boundary.

B1—8 to 11 inches; dark reddish brown (5YR 3/4) silty clay loam, reddish brown (5YR 4/4) dry; moderate fine subangular blocky structure; hard, firm; patchy clay films; medium acid; gradual smooth boundary.

B2t—11 to 18 inches; dark red (2.5YR 3/6) silty clay loam, red (2.5YR 4/6) dry; moderate medium subangular blocky structure; thin clay films on faces of peds; few fine black concretions; medium acid; abrupt wavy boundary.

R—18 to 24 inches; hard limestone bedrock with fractures 1 to 5 inches apart filled with red (2.5YR 4/6) silty clay loam.

The profile is 10 to 20 inches thick over limestone. The A1 or Ap horizon is dark reddish brown, very dark grayish brown, dark brown, or very dark brown. It ranges from slightly acid to medium acid.

The B1 horizon is dark reddish brown, reddish brown, dark brown, dark reddish gray, very dark grayish brown, dark yellowish brown, or dark grayish brown. It is silt loam or silty clay loam and ranges from slightly acid to medium acid. The B2t horizon is dark red, red, yellowish red, dark brown, dark reddish brown, or reddish brown. It is clay loam or silty clay loam and ranges from medium acid to neutral. A few fragments of rock less than 3 inches in diameter occur in some profiles.

Claremore soils are mapped only in complex with Catoosa soils.

Collinsville Series

The Collinsville series consists of gently sloping to strongly sloping soils on uplands. These soils formed in loamy sediment weathered from sandstone under a cover of grasses.

In a representative profile the surface layer is dark brown fine sandy loam 7 inches thick. The subsoil is brown fine sandy loam 5 inches thick. Below this is hard yellowish brown sandstone that is not rippable.

Collinsville soils are well drained to somewhat excessively drained and have moderately rapid permeability. Available water capacity is low. The water table is at a depth of more than 6 feet.

Representative profile of Collinsville fine sandy loam, 3 to 12 percent slopes, 330 feet west and 30 feet south of the northeast corner of sec. 5, T. 7 S., R. 10 E.:

A1—0 to 7 inches; dark brown (7.5YR 3/2) fine sandy loam, brown (7.5YR 5/2) dry; weak and moderate medium granular structure; friable; medium acid; clear smooth boundary.

B2—7 to 12 inches; brown (7.5YR 4/4) fine sandy loam and broken and slightly weathered sandstone, brown (7.5YR 5/4) dry; massive; slightly hard, friable; slightly acid; abrupt smooth boundary.

R—12 to 14 inches; hard yellowish brown sandstone.

The profile ranges from slightly acid to strongly acid, and it is 4 to 20 inches thick over sandstone. The A1 horizon is very dark grayish brown or dark brown. The B2 horizon is brown, dark brown, or dark yellowish brown. It is fine sandy loam or loam and is 0 to 30 percent, by volume, sandstone fragments. Where present, the C horizon is brown, dark brown, or dark yellowish brown. It is fine sandy loam or loam.

19—Collinsville fine sandy loam, 3 to 12 percent slopes. This soil is gently sloping to strongly sloping. Included with this soil in mapping are areas of Bates soils, which make up less than 15 percent of the mapped acreage.

This soil is used mainly for native grass. Tame pasture plants have been established in a few areas.

The main concerns of management are the thickness to sandstone, droughtiness, severe erosion hazard, and strong slopes. Under good management, the soil will produce a fair amount of forage for livestock. The quantity of grass can be maintained or increased by controlling weeds, using suitable grazing practices, and protecting the areas against fire. Growth of tame pasture plants can be increased by adding plant food and preventing overgrazing. A good grass mulch helps to control erosion. Capability unit VIs-1; Shallow Prairie range site; not assigned to a woodland group.

Crockett Series

The Crockett series consists of very gently sloping to sloping soils on uplands. These soils formed in material weathered from clayey sediment under a cover of grasses.

In a representative profile the surface layer is very dark grayish brown loam 7 inches thick. The upper part of the subsoil is mottled reddish brown, gray, and red clay 9 inches thick; the middle part is olive gray clay 18 inches thick; and the lower part is mottled olive gray, brownish yellow, and gray clay 18 inches

thick. The underlying material is mottled light gray, brownish yellow, and white clay to a depth of 64 inches.

Crockett soils are moderately well drained and have very slow permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Crockett loam, 1 to 3 percent slopes, 2,150 feet west and 150 feet south of the northeast corner of sec. 8, T. 8 S., R. 9 E.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; massive; very hard, friable; few fine fragments of gravel; medium acid; abrupt smooth boundary.

B21t—7 to 16 inches; mottled reddish brown (5YR 5/4), gray (10YR 6/1), and red (2.5YR 4/6) clay; moderate fine and medium blocky structure; very hard, very firm; patchy thin clay film on faces of peds; few very fine fragments of gravel; medium acid; gradual smooth boundary.

B22t—16 to 34 inches; olive gray (5Y 4/2) clay, olive gray (5Y 5/2) dry; moderate fine blocky structure; very hard, very firm; patchy clay films on faces of peds; few very fine fragments of gravel; material from B21t horizon in cracks; neutral; gradual smooth boundary.

B3—34 to 52 inches; mottled olive gray (5Y 5/2), brownish yellow (10YR 6/6), and gray (10YR 6/1) clay; weak medium blocky structure; very hard, very firm; thin patchy clay films on faces of peds; few very fine black concretions; common fine carbonate concretions; calcareous; mildly alkaline; clear smooth boundary.

Cca—52 to 64 inches; mottled light gray (10YR 7/1), brownish yellow (10YR 6/6), and white (10YR 8/1) clay with few fine prominent red mottles; massive; hard, firm; few organic root stains; shale fragments in lower part; many small carbonate concretions; calcareous; moderately alkaline.

The profile is more than 60 inches thick. Wide cracks are present during dry periods. The A1 or Ap horizon is very dark grayish brown, dark grayish brown, brown, and dark brown. It ranges from neutral to medium acid.

The B2t horizon is brown, dark brown, light olive brown, dark olive, dark grayish brown, olive, and olive gray; or it is mottled in shades of white, red, gray, brown, yellow, and olive. It ranges from medium acid to neutral. The B3 horizon has texture and color similar to the B2t horizon. The B3 horizon ranges from medium acid to mildly alkaline.

The Cca horizon, where present, is light gray to brownish yellow and white. It ranges from mildly alkaline to moderately alkaline. Carbonate bodies in the B3 and C horizons vary from many to none.

The Crockett soils in the Crockett-Durant complex are slightly outside the range defined for the Crockett series. They lack distinct and coarse mottling in the upper part of the argillic horizon. These differences, however, do not alter use, behavior, or management.

20—Crockett loam, 1 to 3 percent slopes. This soil is very gently sloping. It has a profile described as representative of the series. Included with this soil in mapping are areas of Durant soils, which make up less than 10 percent of the mapped acreage, and areas of Parsons soils, which make up less than 5 percent.

This soil is used for grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture. A small acreage is used for native grass.

The main concerns of management are control of erosion and maintenance of tilth and fertility. Terracing, contour farming, and using all of the crop residue are needed to control erosion. Row cropping needs to be avoided in order to protect the soil from erosion. Planting tame pasture grasses and legumes or native grasses protects this soil from erosion. Capability unit IIIe-2; Claypan Prairie range site; not assigned to a woodland group.

21—Crockett-Durant complex, 1 to 5 percent slopes, eroded. These soils are very gently sloping to gently sloping. The Crockett and Durant soils are in such an intricate pattern that it is not practical to map each separately. Crockett soils are on side slopes, and Durant soils are on crests. These soils have a profile similar to that described as representative for their respective series, but the surface layer is 4 to 9 inches thick and includes material from the subsoil in about 50 percent of the area. Shallow gullies and rills caused by erosion are common throughout the area. About 60 percent of this complex is Crockett loam; 30 percent is Durant loam; and 10 percent is a severely eroded soil that has a profile similar to those described as representative for the Crockett and Durant series, but in which the surface layer is clayey.

These soils are used mostly for tame pasture. The main cultivated crop is wheat.

The main concerns of management are protecting the soil from erosion, increasing water intake, and maintaining tilth and fertility. A cropping system that includes small grain and amounts of plant food that provide for maximum crop residue is needed to increase water intake and control erosion. Row crops should be avoided to prevent further erosion. Terraces, waterways, and contour farming are necessary to reduce the rate of erosion. Gullies need to be shaped and put into permanent vegetation in a few areas. Planting tame pasture grasses and legumes and adding plant food reduce erosion. Capability unit IVe-3; Crockett part in Claypan Prairie range site and Durant part in Loamy Prairie range site; not assigned to a woodland group.

22—Crockett soils, 1 to 6 percent slopes, severely eroded. These soils are very gently sloping to sloping. They have a profile similar to that described as representative for the series, but the surface layer is about 4 inches thick and includes material from the subsoil in about 70 percent of the area. In these areas the surface layer and subsoil are a mixture of loam, clay loam, and clay. About 20 percent of the area is affected by shallow rills and gullies 1 foot to 10 feet deep, 10 to 100 feet wide, and 80 to 500 feet apart. Areas of soil deposition are below the large gullies.

These soils are used mostly for tame pasture. In some areas this soil has reverted to native grasses or trees.

The main concerns of management are controlling the severe hazard of erosion and maintaining tilth and fertility. Cultivated areas need to be returned to such permanent vegetation as tame pasture plants, native grasses, or trees to reduce erosion. Adding plant food, diverting overhead water, and shaping gully banks are necessary for the successful establishment of tame pasture plants. The quality and quantity of tame pas-

ture can be improved by preventing overgrazing, controlling weeds or brush, and adding plant food. Areas suitable for trees can be planted to loblolly pine, shortleaf pine, or southern red oak. The quality of trees can be improved by protecting the areas from fire, by thinning, and by selectively harvesting on a planned schedule. Capability unit VIe-5; Eroded Clay range site; not assigned to a woodland group.

Dennis Series

The Dennis series consists of nearly level to gently sloping soils on uplands. These soils formed in material weathered from loamy and clayey sediment under a cover of grasses.

In a representative profile the surface layer is very dark grayish brown loam 11 inches thick. The upper part of the subsoil is dark brown clay loam 4 inches thick, the middle part is light olive brown silty clay loam 23 inches thick, and the lower part is a coarsely mottled brownish, reddish, and grayish silty clay loam to a depth of 65 inches.

Dennis soils are moderately well drained and have slow permeability. Available water capacity is high. A perched water table is at a depth of 2 to 3 feet during December through April.

Representative profile of Dennis loam, 1 to 3 percent slopes, 440 feet west and 100 feet north of the southeast corner of sec. 26, T. 6 S., R. 8 E.:

A1—0 to 11 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; slightly hard, friable; many fine roots; neutral; gradual smooth boundary.

B1—11 to 15 inches; dark brown (10YR 3/3) clay loam, brown (10YR 4/3) dry; moderate fine subangular blocky structure; hard, firm; few thin clay films; many fine roots; slightly lighter in color in lower 1 inch; few very fine iron concretions; medium acid; gradual smooth boundary.

B21t—15 to 38 inches; light olive brown (2.5Y 5/4) silty clay loam, light yellowish brown (2.5Y 6/4) dry; few fine faint gray and many coarse prominent yellowish red (5YR 5/6) and red (2.5YR 4/6) mottles dry; weak fine and medium blocky structure; very hard, very firm; continuous clay films on peds; few fine roots; few fine organic stains; strongly acid; gradual smooth boundary.

B22t—38 to 56 inches; coarsely mottled grayish brown (2.5Y 5/2), red (2.5YR 4/6), and yellowish red (5YR 5/6) silty clay loam; few fine faint gray mottles; weak coarse blocky structure; very hard, very firm; clay films on ped faces; few fine roots; few fine organic stains; medium acid; gradual smooth boundary.

B3—56 to 65 inches; coarsely mottled dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/6), and gray (10YR 5/1) silty clay loam; weak coarse subangular blocky structure; very hard, very firm; clay films on peds; few fine organic stains; few fine iron concretions; neutral.

The profile is more than 60 inches thick. The A1 or Ap horizon is very dark grayish brown or dark brown. Some profiles have a dark brown A2 horizon. The A horizon mainly ranges from strongly acid to medium acid, but some areas are more alkaline because of liming. Thickness of the A horizon is less than 16 inches.

The B1 horizon is dark yellowish brown, brown, or dark brown. It is silty clay loam or clay loam and ranges from medium acid to very strongly acid. The B2t horizon is dark yellowish brown, brown, dark brown, yellowish brown, olive brown, light olive brown, and strong brown; or it is mottled in shades of brown, gray, yellow, olive, or red. It contains common to many grayish, brownish, reddish, and yellowish mottles. The B2t horizon is clay, clay loam, or silty clay loam. It ranges from slightly acid to strongly acid. The B3 horizon ranges from dark yellowish brown to strong brown and has coarse mottles. It ranges from medium acid to mildly alkaline.

23—Dennis loam, 0 to 1 percent slopes. This soil is nearly level. It has a profile similar to the one described as representative for the series, but the surface layer is about 10 inches thick. Included in mapping are about 5 percent Durant soils and about 10 percent eroded soils that have a profile similar to that described as representative for the Dennis series, but in which the surface layer is about 6 inches thick and is mixed with the subsoil.

This soil is used mostly for soybeans, wheat, grain sorghum, peanuts, cotton, and alfalfa. Tame pasture plants are grown in some areas.

The main concerns of management are controlling erosion on long slopes and maintaining tilth and fertility. This soil can be used continuously for clean-tilled crops if plant food is added and the crop residue is returned to the soil. Proper management of crop residue helps to maintain tilth and improves water intake. In a few areas, diversion terraces on long slopes are used to prevent excessive sheet erosion. Capability unit I-2; Loamy Prairie range site; not assigned to a woodland group.

24—Dennis loam, 1 to 3 percent slopes. This soil is very gently sloping. It has a profile described as representative of the series. Included with this soil in mapping are about 5 percent Durant soils and about 10 percent eroded soils that have a profile similar to that described as representative for the Dennis series, but in which the surface layer is about 6 inches thick and is mixed with material from the subsoil.

This soil is used mostly for grain sorghum, soybeans, wheat, peanuts, and cotton. Some areas are used for tame pasture.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Cropping systems need to provide for the return of adequate amounts of residue to the soil. Erosion can be reduced by contour farming with terraces and by managing crop residue. Plant cover is needed during winter and spring to help to prevent erosion. Using plant food increases plant growth and provides additional crop residue for erosion control. Terracing, contour farming, and using cover crops are especially necessary where row crops are grown. Capability unit IIe-1; Loamy Prairie range site; not assigned to a woodland group.

25—Dennis loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to the one described as representative for the series, but the surface layer is about 10 inches thick. Included with this soil in mapping and making up about 10 percent of the area are Durant and Muskogee soils. Also included and making up about 10 percent of the acreage is an

eroded soil that has a profile similar to that described as representative for the Dennis series, but in which the surface layer is about 5 inches thick and is mixed with material from the subsoil.

This soil is used for grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture plants. A small acreage is used for native grass.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Terracing, contour farming, and using all of the crop residue are necessary to control erosion. Row cropping needs to be avoided to protect the soil from erosion. Planting tame pasture grasses and legumes or native grasses protects this soil from erosion. Capability unit IIIe-2; Loamy Prairie range site; not assigned to a woodland group.

Durant Series

The Durant series consists of very gently sloping to sloping soils on uplands. These soils formed in material weathered from loamy and clayey sediment under a cover of grasses.

In a representative profile the surface layer is very dark grayish brown loam 8 inches thick. The upper part of the subsoil is dark brown silty clay loam 3 inches thick, the middle part is olive brown and brown clay 36 inches thick, and the lower part is olive brown clay to a depth of 64 inches.

Durant soils are moderately well drained and have very slow permeability. Available water capacity is high. The water table is at a depth of more than 6 feet.

Representative profile of Durant loam, 1 to 3 percent slopes, 900 feet north and 150 feet east of the southwest corner of sec. 35, T. 7 S., R. 10 E.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; slightly hard, friable; medium acid; gradual smooth boundary.

B1—8 to 11 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; few fine distinct reddish brown mottles; moderate fine and medium subangular blocky structure; hard, firm; medium acid; gradual smooth boundary.

B21t—11 to 30 inches; olive brown (2.5Y 4/4) clay, light olive brown (2.5Y 5/4) dry; common medium prominent yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, very firm; many shiny ped faces; common dark stains; medium acid; gradual smooth boundary.

B22t—30 to 47 inches; brown (10YR 4/3) clay, brown (10YR 5/3) dry; few fine faint light brownish gray mottles; weak medium blocky structure; very hard, very firm; many shiny ped faces; common dark stains; neutral; gradual smooth boundary.

B3—47 to 64 inches; olive brown (2.5Y 4/4) clay, light olive brown (2.5Y 5/4) dry; few fine faint grayish brown mottles; weak coarse blocky structure; extremely hard, very firm; few shiny ped faces; few calcium carbonate concretions; moderately alkaline.

The profile is more than 60 inches thick. Calcium carbonate concretions or disseminated lime occurs in the lower part of the B horizon. The A1 or Ap horizon is very dark grayish brown or dark brown. It is loam or silt loam and ranges from slightly acid to medium acid.

The B1 horizon is brown, dark brown, very dark grayish brown, dark yellowish brown, or yellowish brown. It ranges from clay loam to clay and is slightly acid to medium acid. The B2t horizon is grayish brown, dark grayish brown, dark yellowish brown, yellowish brown, light olive brown, or olive brown. It commonly has brownish, reddish, or grayish colored mottles. It ranges from medium acid to neutral. The B3 horizon is grayish brown, dark grayish brown, dark yellowish brown, yellowish brown, light olive brown, olive brown, light yellowish brown, brown, brownish yellow, or olive yellow. Reddish, brownish, or grayish mottles occur in some pedons. The B3 horizon ranges from slightly acid to moderately alkaline.

26—Durant loam, 1 to 3 percent slopes. This soil is very gently sloping. It has the profile described as representative for the series (fig. 2). Included in mapping are about 10 percent Crockett soils and 5 percent Dennis soils. Also included are a few small areas of eroded soils in cultivated fields.

This soil is used mostly for grain sorghum, soybeans, wheat, peanuts, and cotton. Tame pasture plants are grown in some areas.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Cropping systems need to provide for the return of adequate amounts of residue to the soil. Erosion can be reduced by contour farming with terraces and by managing crop residue. Plant cover is needed during winter and spring to help prevent erosion. Using plant food increases plant growth and provides additional crop residue for erosion control. Terracing, contour farm-

Figure 2.—**Profile of Durant loam, 1 to 3 percent slopes.**

ing, and using cover crops are especially necessary where row crops are grown. Capability unit IIe-1; Loamy Prairie range site; not assigned to a woodland group.

27—Durant loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to that described as representative for the series, but the surface layer is about 11 inches thick. Included with this soil in mapping and making up 20 percent of the acreage is a soil that has a profile similar to that described as representative for the Durant series, but the lower part of the subsoil has coarse reddish, grayish, and brownish mottles or the surface layer is about 4 inches thick and includes material from the subsoil in eroded areas.

This soil is used for grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture. A small acreage is used for native grass.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Terracing, contour farming, and using all of the crop residue are necessary to control erosion. Row cropping needs to be avoided to protect the soil from erosion. Planting tame pasture grasses and legumes or native grasses protects this soil from erosion. Capability unit IIIe-2; Loamy Prairie range site; not assigned to a woodland group.

28—Durant-Verdigris complex. The soils in this complex occur in small valleys cut into smoother uplands along the upper parts of flood plains. These soils are in such an intricate pattern that it was not practical to map them separately. The Durant soils are very gently sloping to gently sloping and are on sides of small valleys. The Verdigris soils are nearly level and are on flood plains. The small valleys are 180 to 600 feet wide at the top and are at an elevation that is 10 to 40 feet below the surrounding uplands. The flood plains are 20 to 100 feet wide. The profile for each soil in this complex is similar to that described as representative for its respective series, but the Durant soils have a surface layer of silt loam and the Verdigris soils have a surface layer of silt loam and clay loam. About 60 percent of this complex is Durant silt loam, 25 percent is frequently flooded Verdigris silty clay loam, and 15 percent is Dennis, Crockett, Muskogee, and Bernow soils and areas of a strongly sloping soil that has a profile similar to that described as representative for the Durant series, but the surface layer is 4 to 8 inches thick.

These soils are mostly used for native grass and woodland. A few areas are in tame pasture.

The main concerns of management are the strong slopes, erosion, and the hazard of flooding. Native grass can be maintained or improved by controlling brush, using suitable grazing practices, and preventing fire. The wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule. In tame pasture areas, adding plant food and preventing overgrazing help to provide a grass mulch that protects the soils from erosion during floods. Capability unit VIe-4; Durant part in Loamy Prairie range site, and Verdigris part not assigned to a range site; Verdigris part in woodland group 2o, and Durant part not assigned to a woodland group.

Eufaula Series

The Eufaula series consists of gently sloping to moderately steep soils on uplands. These soils formed in material weathered from sandy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is dark grayish brown fine sand 5 inches thick. The subsurface layer is light gray fine sand 51 inches thick. Below this is pale brown fine sand and yellowish red loamy fine sand.

Eufaula soils are somewhat excessively drained and have rapid permeability. Available water capacity is low. The water table is at a depth of more than 6 feet.

Representative profile of Eufaula fine sand, 3 to 15 percent slopes, 400 feet west and 300 feet south of the northeast corner of sec. 15, T. 8 S., R. 7 E.:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sand, light brownish gray (10YR 6/2) dry; structureless; loose, moist; medium acid; clear wavy boundary.

A21—5 to 56 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, moist; slightly acid; clear smooth boundary.

B2t&A22—56 to 80 inches; pale brown (10YR 6/3) fine sand, very pale brown (10YR 7/3) dry (A2); yellowish red (5YR 5/6) loamy fine sand, reddish yellow (5YR 6/6) dry (B2t); weak coarse prismatic and weak coarse subangular blocky structure; slightly hard, very friable; patchy clay films on faces of peds; clean sand grains in A2 part; slightly acid.

The profile is more than 60 inches thick. The A1 horizon is more than 40 inches thick. It is grayish brown, dark brown, brown, dark yellowish brown, dark grayish brown, or yellowish brown, and it ranges from medium acid to slightly acid. The A2 horizon is light brownish gray, light gray, pale brown, light yellowish brown, pinkish gray, pink, or light brown. It is fine sand or loamy sand and ranges from slightly to medium acid.

The B2t horizon is strong brown or yellowish red. In some profiles it has a few thin red strata. The B2t horizon is loamy fine sand or fine sandy loam but is mainly loamy fine sand. It ranges from slightly acid to medium acid.

29—Eufaula fine sand, 3 to 15 percent slopes. This soil is gently sloping to moderately steep. Included with this soil in mapping and making up about 15 percent of the area are areas of Larton soils.

This soil is used mainly for native grasses and tame pasture.

The main concerns of management are the strong to moderately steep slopes, erosion, and soil fertility. Preventing overgrazing, controlling brush, and protecting the areas from fire will improve the quality and quantity of native grasses and tame pasture. Adding plant food and preventing overgrazing increase the growth of tame pasture plants and provide a grass mulch that reduces erosion. Capability unit VIe-6; Deep Sand Savannah range site; not assigned to a woodland group.

Ferris Series

The Ferris series consists of very gently sloping to moderately steep soils on uplands. These soils formed in material weathered from shaly clay or shale under a cover of native grasses.

In a representative profile the surface layer is very dark grayish brown clay 8 inches thick. The next layer is mottled olive gray, olive, and light olive brown clay 35 inches thick. The underlying material is coarsely mottled light olive brown and olive gray shaly clay to a depth of 60 inches.

Ferris soils are well drained and have very slow permeability. Available water capacity is medium. The depth to the water table is more than 6 feet.

Representative profile of Ferris clay, 1 to 5 percent slopes, eroded, 1,400 feet south and 2,000 feet west of the northeast corner of sec. 14, T. 5 S., R. 11 E.:

A1—0 to 8 inches; very dark grayish brown (2.5Y 3/2) clay, grayish brown (2.5Y 5/2) dry; moderate fine granular structure; very hard, firm; sticky and plastic; soil mulch ½ inch thick on surface; few fine calcium carbonate concretions; common fine grass roots; calcareous; moderately alkaline; gradual wavy boundary.

AC1—8 to 24 inches; mottled olive gray (5Y 4/2) and olive (5Y 5/4) clay with seams of pale olive (5Y 6/3) silty clay loam; moderate medium blocky structure; very hard, very firm; very sticky and very plastic; common shiny pressure faces; few fine manganese concretions; few fine grass roots; few small shells; calcareous; moderately alkaline; gradual smooth boundary.

AC2—24 to 43 inches; mottled olive gray (5Y 4/2) and light olive brown (2.5Y 5/6) clay; moderate medium blocky structure; very hard, very firm; very sticky and very plastic; few roots; common medium and coarse intersecting slickensides at a depth of more than 30 inches; parallelepipeds have long axes tilted as much as 40 percent; many pressure faces; common fine manganese concretions; some organic stains on ped faces; common small shells; calcareous; moderately alkaline; gradual smooth boundary.

C—43 to 60 inches; coarsely mottled light olive brown (2.5Y 5/6) and olive gray (5Y 5/2) shaly clay; few fine mottles of reddish yellow; weak medium blocky structure mixed with coarse blocky rock (shale); very sticky and very plastic; few slickensides in upper horizon; many shiny pressure faces; common fine manganese concretions; many small shells; organic stains on some ped faces; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. Deep and wide cracks are common during dry periods. The A1 or Ap horizon is grayish brown, dark grayish brown, very dark brown, very dark grayish brown, brown, or dark brown. Where very dark brown or very dark grayish brown, the A1 or Ap horizon is less than 12 inches thick.

The AC horizon is dark yellowish brown, yellowish brown, brown, light olive brown, olive brown, or olive, or it is mottled in shades of brown or olive. In most places it has mottles in shades of gray, brown, olive, or yellow. Concretions and soft deposits of calcium carbonate make up 2 to 35 percent of the AC horizon and the C horizon. The C horizon ranges from dark yellowish brown to olive. It ranges from strongly weathered shaly clay to calcareous shales.

30—Ferris clay, 1 to 5 percent slopes, eroded. This soil is very gently sloping to gently sloping. The profile in about 40 percent of the mapped area is similar to that described as representative for the series, but the surface layer is about 4 inches thick and includes material from the subsoil. Shallow gullies and rills created by erosion are common throughout the area. Included with this soil in mapping are 10 percent Matoy soils, 5 percent Burleson soils, and 5 percent Heiden soils.

This soil is used mostly for tame pasture. The main cultivated crop is wheat. This soil is also suited to cotton and native grasses.

The main concerns of management are protecting the soil from erosion, increasing water intake, and maintaining tilth and fertility. A cropping system that includes small grain and amounts of plant food that provide for maximum crop residue is needed to increase water intake and control erosion. Row crops should be avoided to prevent further erosion. Terraces, waterways, and contour farming are necessary to reduce the rate of erosion. Gullies need to be shaped and put into permanent vegetation in a few areas. Tame pasture grasses and legumes and additions of plant food are suitable for reducing erosion. Capability unit IVe-3; Blackclay Prairie range site; not assigned to a woodland group.

31—Ferris clay, 8 to 20 percent slopes. This soil is gently sloping to moderately steep. It has a profile similar to the one described as representative of the series, but the surface layer is 7 inches thick. Included with this soil in mapping are 5 percent Matoy soils and 5 percent Tarrant soils. Also included and making up 15 percent of the mapped area are areas of soils that have a profile similar to that described as representative for the Ferris series, but the surface layer is noncalcareous.

This soil is used mainly for native grasses. A few areas are in tame pasture.

The main concerns of management are the shallow depth to limestone in some areas, slow water intake, tilth, and rock outcrops. The use of machinery is limited in areas of rock outcrop. Preventing overgrazing of native grasses and tame pasture improves water intake, reduces erosion, and maintains tilth. The quality of grasses can be maintained or improved by preventing overgrazing, controlling weeds, and protecting the area from fire. Adding plant food and preventing overgrazing improve the quality and quantity of tame pasture plants and protect the soil from erosion. Capability unit VIe-1; Blackclay Prairie range site; not assigned to a woodland group.

32—Ferris-Romia complex, 5 to 20 percent slopes. These soils are sloping to moderately steep. The Ferris and Romia soils are in such an intricate pattern that it is impractical to map them separately. The Ferris soil is on the upper part of side slopes, and the Romia soil is on the lower part of side slopes. The profile of each soil in this complex is similar to that described as representative for its respective series, but the Ferris soil has a surface layer about 6 inches thick and the Romia soil has a surface layer of fine sandy loam. About 60 percent of this complex is Ferris clay, 30 percent is Romia loamy fine sand, 5 percent is Bosville soils, and 5 percent is Matoy soils.

These soils are mostly used for native grass or wood-

land. Some areas of these soils are used for tame pasture.

The main concerns of management are preventing erosion and maintaining tilth. Proper management of native grasses, woodlands, and tame pasture will maintain tilth and reduce erosion. Preventing overgrazing, controlling brush, and protecting the soil from fire will improve the quantity and quality of native grasses. The wooded areas can be improved by removing inferior species, planting suitable species, selectively harvesting trees on a planned schedule, and protecting the area from fire. Adding plant food and preventing overgrazing improve tame pasture plants and help to control erosion. Capability unit VIe-3; Ferris part in Blackclay Prairie range site, and Romia part in Sandy Savannah range site; Romia part in woodland group 4f, and Ferris part not assigned to a woodland group.

33—Ferris-Tarrant complex, 8 to 20 percent slopes. These soils are strongly sloping to moderately steep. The Ferris and Tarrant soils are in such an intricate pattern that it is impractical to map them separately. The Ferris soil is generally on side slopes, and the Tarrant soil is on the crest of ridges. The profile for each soil in this complex is similar to that described as representative for its respective series, but the Tarrant soil has a surface layer that is less cobbly and is stony silty clay and clay. About 50 percent of this complex is Ferris clay, 35 percent is Tarrant soils, and 15 percent is Matoy and San Saba soils.

These soils are used mainly for native grass. A few areas are in tame pasture.

The main concerns of management are shallow depth to limestone in some areas, slow water intake, tilth, and rock outcrops. The use of farm machinery is limited in areas of rock outcrop. Preventing overgrazing of native grasses and tame pasture improves water intake, reduces erosion, and maintains tilth. The quality of grasses can be maintained or improved by preventing overgrazing, controlling weeds, and protecting the area from fire. Adding plant food and preventing overgrazing improve the quality and quantity of tame pasture plants and protect the soil from erosion. Capability unit VIe-1; Ferris part in Blackclay Prairie range site, and Tarrant part in Very Shallow range site; not assigned to a woodland group.

Fitzhugh Series

The Fitzhugh series consists of very gently sloping to gently sloping soils on uplands. These soils formed in loamy material weathered from sandstone under a cover of native grasses.

In a representative profile the surface layer is very dark grayish brown loam 11 inches thick. The upper part of the subsoil is dark yellowish brown loam 7 inches thick; the middle part is brown clay loam 26 inches thick; and the lower part is brown, pale brown, and yellowish red clay loam 7 inches thick. The underlying material is rippable, yellowish fractured sandstone to a depth of 60 inches.

Fitzhugh soils are well drained and have moderate permeability. Available water capacity is high. The water table is at a depth of more than 6 feet.

Representative profile of Fitzhugh loam in an area of Fitzhugh-Bates complex, 1 to 5 percent slopes, eroded, 2,400 feet north and 1,000 feet east of the southwest corner of sec. 21, T. 6 S., R. 8 E.:

Ap—0 to 11 inches; very dark grayish (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; slightly hard, friable; medium acid; gradual smooth boundary.

B1—11 to 18 inches; dark yellowish brown (10YR 4/4) loam, yellowish brown (10YR 5/4) dry; moderate fine subangular blocky structure; hard, firm; thin clay films, few worm castings; few small reddish particles and fine rock fragments; medium acid; gradual smooth boundary.

B21t—18 to 34 inches; brown (7.5YR 5/4) clay loam, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure; hard, firm; clay films on faces of peds; few fine manganese concretions; common fine reddish particles and few rock fragments; slightly acid; gradual smooth boundary.

B22t—34 to 44 inches; coarsely mottled brown (7.5YR 5/4), pale brown (10YR 6/3), and yellowish red (5YR 5/6) clay loam; moderate medium subangular blocky structure; hard, firm; thin clay films on faces of peds; few fine rock fragments and reddish particles; few fine soft and hard manganese concretions; medium acid; gradual smooth boundary.

B3—44 to 51 inches; coarsely mottled brown (7.5YR 5/4), pale brown (10YR 6/3), and yellowish red (5YR 5/6) clay loam; weak coarse subangular blocky structure; hard, firm; thin clay films on faces of peds; common black soft material; few fine manganese concretions; medium acid; clear smooth boundary.

C—51 to 60 inches; yellowish fractured sandstone.

Depth to bedrock is 40 to 60 inches. The A1 or Ap horizon is very dark grayish brown or dark brown. It is typically loam but is fine sandy loam in places. It ranges from slightly acid to medium acid.

The B1 horizon is dark grayish brown, brown, dark yellowish brown, yellowish brown, strong brown, dark brown, and very dark grayish brown. The B2t and B3 horizons are brown, yellowish red, reddish brown, or red, or they are coarsely mottled in shades of brown and red. In some pedons these horizons contain fine to coarse brownish or reddish mottles. The B2t and B3 horizons are loam or clay loam and range from slightly acid to strongly acid.

34—Fitzhugh fine sandy loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to that described as representative for the series, but the surface layer is fine sandy loam about 12 inches thick. Included with this soil in mapping are about 10 percent Dennis soils and 10 percent Bates soils.

This soil is used for grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture. A small acreage is used for native grass.

The main concerns of management are controlling erosion and maintaining tilth and fertility. Terracing, contour farming, and using all of the crop residue are necessary to control erosion. Row cropping needs to be avoided to protect the soil from erosion. Planting tame pasture and legumes or native grasses protects this soil from erosion. Capability unit IIIe-2; Loamy Prairie range site; not assigned to a woodland group.

35—Fitzhugh-Bates complex, 1 to 5 percent slopes, eroded. These soils are very gently sloping to gently

sloping and are eroded. The Fitzhugh and Bates soils are in such an intricate pattern that it is impractical to map each separately. The Bates soils are on ridge crests, and the Fitzhugh soils are on side slopes. The Fitzhugh soils have a profile similar to the one described as representative for the series, but in places the surface layer is fine sandy loam. The Bates soils have a profile similar to that described as representative for the series, but depth to sandstone is about 32 inches. In eroded areas of this complex, the surface layer is about 6 inches thick and in about 50 percent of these areas, it includes material from the subsoil in a spotty pattern. Rills are common. Gullies are 1 foot to 3 feet deep, 5 to 12 feet wide, and about 300 feet apart. About 40 percent of this complex is Fitzhugh fine sandy loam or loam; 20 percent is Bates fine sandy loam; and 40 percent is soils similar to Fitzhugh loam or fine sandy loam and Bates fine sandy loam, but the surface layer is a mixture of fine sandy loam, loam, and clay loam.

These soils are used mostly for tame pasture. The main cultivated crop is wheat. These soils are also suited to native grasses.

The main concerns of management are maintaining tilth and fertility and protecting the soil from erosion. A cropping system that includes small grains and amounts of plant food that provide for maximum residue is needed to control further erosion. Terraces, waterways, and contour farming are necessary to reduce the rate of erosion. In a few areas, gullies need to be shaped and put into permanent vegetation. Row crops should be avoided to prevent excessive erosion. Planting native grasses or tame pasture grasses and legumes and adding plant food reduce erosion. Capability unit IIIe-5; Loamy Prairie range site; not assigned to a woodland group.

Freestone Series

The Freestone series consists of very gently sloping to gently sloping soils on uplands. These soils formed in material weathered from clayey sediments under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is dark grayish brown fine sandy loam 8 inches thick. The subsurface layer is brown fine sandy loam 6 inches thick. The upper 14 inches of the subsoil is yellowish brown sandy clay loam; the middle 14 inches is mottled yellowish brown, light brownish gray, and reddish yellow clay loam; and the lower 22 inches is yellowish brown clay loam.

Freestone soils are moderately well drained and have slow permeability. Available water capacity is high. A water table is at a depth of 1 foot to 3 feet during December through May.

Representative profile of Freestone fine sandy loam, 1 to 5 percent slopes, 100 feet south and 250 feet east of the northwest corner of sec. 2, T. 6 S., R. 12 E.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; hard, very friable; medium acid; clear smooth boundary.

A2—8 to 14 inches; brown (10YR 4/3) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; hard, friable; medium acid; clear smooth boundary.

B21t—14 to 28 inches; yellowish brown (10YR 5/4) sandy clay loam, light yellowish brown (10YR 6/4) dry; few coarse prominent yellowish red (5YR 5/6) mottles dry; moderate fine subangular blocky structure; very hard, firm; few thin clay films on faces of peds; strongly acid; clear smooth boundary.

B22t&A'2—28 to 42 inches; mottled yellowish brown (10YR 5/4), light brownish gray (10YR 6/2), and reddish yellow (5YR 6/6) clay loam; moderate medium subangular blocky structure; uncoated sand and silt grains in streaks and pockets and on vertical faces; hard, firm; clay films on faces of peds; slightly acid; gradual smooth boundary.

B23t—42 to 64 inches; yellowish brown (10YR 5/6) clay loam, brownish yellow (10YR 6/6) dry; many coarse prominent reddish yellow (7.5YR 6/6) and gray (10YR 6/1) mottles dry; weak medium subangular blocky structure; very hard, firm; thin clay films on faces of peds; mildly alkaline.

Depth to bedrock is more than 60 inches. The A1 or Ap horizon is brown or dark grayish brown. It ranges from medium acid to neutral. The A2 horizon is brown, grayish brown, light brownish gray, pale brown, or gray. It ranges from medium acid to neutral. The B21t horizon is strong brown, yellowish brown, brownish yellow, or reddish yellow and has grayish or reddish mottles. It is sandy clay loam or loam and ranges from strongly acid to neutral. The B22t and A'2 and B23t horizons are strong brown, yellowish brown, brownish yellow or reddish yellow and are mottled in shades of brown, gray, red, and yellow. They are sandy clay loam, clay loam, or clay and range from slightly acid to mildly alkaline.

36—Freestone fine sandy loam, 1 to 5 percent slopes. This soil is very gently sloping to gently sloping. Included with this soil in mapping are less than 10 percent areas of Muldrow soils, less than 5 percent areas of Muskogee soils, and less than 15 percent areas of a soil similar to this Freestone soil that is not mottled in the upper part of the subsoil.

This soil is used mostly for tame pasture, wheat, grain sorghum, peanuts, soybeans, and cotton. A small acreage is used for woodland and native grasses.

The main concerns in management are controlling erosion and maintaining tilth and fertility. A large amount of crop residue needs to be returned to the soil and plant food needs to be added to help maintain tilth and fertility. High residue crops such as wheat need to be dominant in the cropping system where row crops are grown. Terracing, contour farming, and using crop residue help to control erosion. Capability unit IIIe-4; Loamy Savannah range site; woodland group 3w.

Frioton Series

The Frioton series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy and clayey sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is 24 inches of very dark brown silty clay loam over 13 inches of very dark gray silty clay loam. The underlying material is very dark gray silty clay loam and 10 percent fragments of limestone to a depth of 62 inches.

Frioton soils are well drained and have moderately slow permeability. Available water capacity is high. The water table is at a depth of more than 6 feet. These soils are subject to flooding.

Representative profile of Frioton silty clay loam, 360 feet east and 820 feet south of the northwest corner of sec. 24, T. 5 S., R. 9 E.:

A11—0 to 24 inches; very dark brown (10YR 2/2) silty clay loam, very dark gray (10YR 3/1) dry; strong fine granular structure; hard, friable; 10 percent, by volume, fragments of limestone less than 3 inches in diameter in the lower part; calcareous; moderately alkaline; diffuse smooth boundary.

A12—24 to 37 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; hard, firm; 2 percent, by volume, fragments of limestone less than 3 inches in diameter; few fine threads of carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—37 to 62 inches, very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; massive; hard, firm; 10 percent, by volume, fragments of limestone less than 3 inches in diameter; calcareous; moderately alkaline.

Depth to bedrock is more than 60 inches. The A horizon ranges from 24 inches to more than 50 inches thick. The A1 or Ap horizon is black, very dark brown, very dark gray, very dark grayish brown, or dark brown. It ranges from mildly alkaline to moderately alkaline. In some profiles it is noncalcareous in the upper 10 inches. The A12 and C horizons are silty clay loam, silty clay, gravelly silty clay loam, or gravelly silty clay and are 5 to 15 percent, by volume, fragments of chert or limestone. The C horizon is very dark gray, very dark grayish brown, dark brown, dark gray, dark grayish brown, brown, or gray. In some profiles it contains thin layers of loamy or clayey sediment.

37—Frioton silty clay loam. This soil is nearly level. It is subject to occasional flooding. Included with this soil in mapping are about 5 percent areas of Gowton, Trinity and Verdigris soils and 10 percent areas of a soil that has a profile similar to the one described as representative of the series but that is less than 60 inches over limestone or is not calcareous in the upper 20 inches.

This soil is used mostly for tame pasture, grain sorghum, wheat, soybeans, cotton, peanuts, and alfalfa hay. Sizable areas are managed for woodland.

The main concerns in management are occasional flooding and maintaining tilth. Close-grown crops are needed late in fall, in winter, and in spring to prevent erosion during flooding. Planting in spring needs to be delayed until after the period of common flooding. Most crops that produce a large amount of residue can be grown continuously where plant food is added that provides for maximum crop residue. Maintaining the organic matter content of this soil contributes to good tilth and intake of water. Minimum tillage needs to be used. Tame pasture or woodland protects this soil during flooding. Capability unit IIw-2; not assigned to range site; woodland group 2o.

Gowton Series

The Gowton series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is 17 inches of very dark grayish brown loam over 14 inches of dark brown clay loam. The underlying material is brown clay loam to a depth of 60 inches.

Gowton soils are well drained and have moderate permeability. Available water capacity is high. The water table is at a depth of more than 6 feet. These soils are subject to flooding.

Representative profile of Gowton loam, 2,300 feet south and 660 feet east of the northwest corner of sec. 32, T. 6 S., R. 12 E.:

A11—0 to 17 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; soft, friable; slightly acid; gradual smooth boundary.

A12—17 to 31 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate fine granular structure; slightly hard, friable; few fine dark concretions; medium acid; gradual smooth boundary.

C—31 to 60 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; few fine faint yellowish brown mottles; massive; hard, firm; few fine dark concretions; few thin strata of fine sandy loam in lower part; moderately alkaline.

Depth to bedrock is more than 60 inches. The A1 horizon is 24 to 45 inches thick. It is black, very dark brown, very dark gray, very dark grayish brown, or dark brown. It ranges from medium acid to mildly alkaline. The C horizon is black to dark brown or is dark grayish brown or brown. Grayish or brownish mottles are commonly below a depth of 30 inches. The C horizon and the lower part of the A horizon are loam or clay loam. The C horizon ranges from slightly acid to moderately alkaline and is calcareous in the lower part in some profiles.

38—Gowton loam. This soil is nearly level and is subject to occasional flooding. Included with this soil in mapping are areas of Frioton, Verdigris, and Kaufman soils, each making up about 5 percent of the mapped acreage.

This soil is used mostly for tame pasture, grain sorghum, wheat, soybeans, cotton, peanuts, and alfalfa hay. Sizable areas are managed for woodland.

The main concerns in management are occasional flooding and maintaining tilth. Close-grown crops are needed during periods of flooding. Planting in spring needs to be delayed until after the period of common flooding. Most crops that produce a large amount of residue can be grown continuously where plant food is added that provides for maximum crop residue. Maintaining organic matter content contributes to good tilth and intake of water. Minimum tillage needs to be used. Tame pasture or woodland protects this soil during flooding. Capability unit IIw-2; not assigned to range site; woodland group 2o.

Guyton Series

The Guyton series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is grayish brown silt loam 8 inches thick. The subsurface layer is light brownish gray silt loam 9 inches thick.

The upper part of the subsoil is grayish brown silty clay loam 25 inches thick, the middle part is mottled light brownish gray silt loam and brownish yellow silty clay loam 15 inches thick, and the lower part is mottled light brownish gray and yellowish red silty clay loam and gray silt loam to a depth of 65 inches.

Guyton soils are poorly drained and have slow permeability. Available water capacity is medium. The water table is at a depth of 0 to 1.5 feet during December through May. These soils are subject to flooding.

Representative profile of Guyton silt loam, 400 feet west and 2,700 feet north of the southeast corner of sec. 36, T. 7 S., R. 13 E.:

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, light brownish gray (10YR 6/2) dry; few coarse prominent yellowish red (5YR 4/6) mottles moist; weak granular structure; slightly hard, friable; medium acid; clear smooth boundary.

A2g—8 to 17 inches; light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; few coarse prominent yellowish red (5YR 4/6) mottles moist; weak fine granular structure; slightly hard, friable; strongly acid; abrupt irregular boundary.

B21tg—17 to 26 inches; grayish brown (10YR 5/2) silty clay loam, light brownish gray (10YR 6/2) dry; 15 percent tongues ½ inch to 1½ inches wide of light gray (10YR 7/2) silt loam; common medium distinct brownish yellow (10YR 6/6) mottles moist; weak medium prismatic structure and moderate medium subangular blocky; very hard, very firm; prisms have silt coatings from A2g horizon; continuous clay films on many peds; medium acid; gradual smooth boundary.

B22tg—26 to 42 inches; grayish brown (2.5Y 5/2) silty clay loam, light brownish gray (2.5Y 6/2) dry; common coarse distinct yellowish brown (10YR 5/6) mottles moist; weak medium prismatic structure and moderate medium subangular blocky; very hard, very firm; medium acid; gradual smooth boundary.

B23tg—42 to 57 inches; mottles and bodies of light brownish gray (10YR 6/2) silt loam and brownish yellow (10YR 6/6) silty clay loam moist; weak coarse subangular blocky structure; very hard, firm; peds coated with silt; some organic stains in root channels; few fine manganese concretions; clay film on many peds; medium acid; gradual smooth boundary.

B3tg—57 to 65 inches; mottles and bodies of light brownish gray (10YR 6/2) and yellowish red (5YR 5/6) silty clay loam and gray (10YR 6/1) silt loam; weak coarse subangular blocky structure; very hard, very firm; common fine manganese concretions; some organic stains; moderately alkaline.

The depth to bedrock is more than 60 inches. The A horizon is 16 to 30 inches thick. The A1 or Ap horizon is grayish brown or dark grayish brown. The A2g horizon is light brownish gray or gray. The A horizon ranges from very strongly acid to strongly acid, except where limed. The B2tg horizon is light brownish gray, gray, or grayish brown. It is silty clay loam or clay loam and ranges from very strongly acid to medium acid. The B3tg horizon is generally lighter in color than the B2tg horizon and is coarsely mottled with shades of yellow, gray, brown, and red. It is silt loam, silty clay loam, or clay loam, and it ranges from medium acid to moderately alkaline.

39—Guyton silt loam. This soil is nearly level. It is subject to rare flooding. Included with this soil in mapping and making up 10 percent of the mapped acreage is a soil similar to this Guyton soil but that is on low mounds about 100 feet in diameter and that has a surface layer more than 24 inches thick. Also included in 20 percent of the mapped area is a soil that has a profile similar to the one described as representative of the series, except it lacks tongues of light gray silt loam in the upper subsoil or it has a more clayey subsoil.

This soil is suited to tame pasture, wheat, soybeans, peanuts, grain sorghum, and cotton. Some areas are managed for woodland.

The main concerns in management are wetness and maintaining tilth and fertility. Crops that produce a large amount of residue can be grown continuously where plant food is added. Use of crop residue helps to maintain organic matter, tilth, and fertility. A drainage system coupled with arranging rows for drainage reduces wetness and helps to improve crop production. Capability unit IIIw-1; not assigned to range site; woodland group 3w.

Heiden Series

The Heiden series consists of very gently sloping to gently sloping soils on uplands. These soils formed in material weathered from shaly clay under a cover of native grasses.

In a representative profile the surface layer is 8 inches of black clay over 10 inches of very dark brown clay. The next layer is olive brown clay 24 inches thick. The underlying material is olive shaly clay to a depth of 62 inches.

Heiden soils are well drained and have very slow permeability. Available water capacity is medium. The depth to the water table is more than 6 feet.

Representative profile of Heiden clay, 3 to 5 percent slopes, 1,880 feet east and 150 feet north of the southwest corner of sec. 20, T. 5 S., R. 8 E.:

A1—0 to 8 inches; black (10YR 2/1) clay, dark gray (10YR 4/1) dry; strong fine granular and subangular blocky structure; very hard, very firm; mildly alkaline; gradual smooth boundary.

A12—8 to 18 inches; very dark brown (10YR 2/2) clay, very dark grayish brown (10YR 3/2) dry; strong medium blocky structure; very hard, very firm; mildly alkaline; gradual smooth boundary.

AC—18 to 42 inches; olive brown (2.5Y 4/4) clay, light olive brown (2.5Y 5/4) dry; moderate medium blocky structure; very hard, very firm; few intersecting slickensides; common fine calcium carbonate concretions; few fine manganese concretions; calcareous, moderately alkaline; gradual smooth boundary.

C—42 to 62 inches; olive (5Y 4/4) shaly clay, olive (5Y 5/4) dry; weak medium and coarse blocky structure; very hard, very firm; few intersecting slickensides; common fine calcium carbonate concretions; few fine manganese concretions; calcareous, moderately alkaline.

The depth to bedrock is more than 60 inches. Wide cracks are present during dry periods. The A1 or Ap horizon is very dark brown, very dark grayish brown, black, or very dark gray. The A horizon is less than 12 inches thick in areas where it is black or very dark gray. It is calcareous or noncalcareous and ranges from mildly alkaline to moderately alkaline. The AC horizon is grayish brown, yellowish brown, brown, dark grayish brown, dark yellowish brown, light olive brown, olive brown, olive gray, or olive. In some profiles it has yellowish or olive mottles. The C horizon ranges from strongly weathered shaly clay to slightly weathered calcareous shale.

40—Heiden clay, 3 to 5 percent slopes. This soil is gently sloping. It has a profile described as representative of the series. Included with this soil in mapping are areas of Burleson, Ferris, and San Saba soils, each making up about 5 percent of the mapped acreage.

This soil is used for grain sorghum, wheat, cotton, and tame pasture. A few areas are managed for native grasses.

The main concerns in management are controlling erosion, increasing water intake, preventing surface crusting, and maintaining tilth. Crops that produce a large amount of residue need to be used in the cropping system. Terracing, contour farming, and using cover crops help control erosion. Adding plant food that provides for maximum crop residue increases organic matter, improves water intake, maintains tilth, and prevents surface crusting. Row crops need to be avoided to protect the soil from erosion. Tillage needs to be timely and kept to a minimum. Capability unit IIIe-3; Blackclay Prairie range site; not assigned to woodland group.

41—Heiden stony soils, 2 to 5 percent slopes. These soils are very gently sloping to gently sloping. They have a profile similar to the one described as representative of the series, but the surface layer contains about 25 percent stones. Included with these soils in mapping are areas of Burleson and San Saba soils, which make up about 25 percent of the mapped acreage, and areas of Tarrant soils, which make up about 15 percent.

These soils are used mainly for native grasses. A few areas are in tame pasture.

The main concerns in management are depth to limestone, slow water intake, tilth, and rock outcrop. The use of farm machinery is limited in areas of rock outcrop. Preventing overgrazing of native grasses and tame pasture improves water intake, reduces erosion, and maintains tilth. The quality of grasses can be maintained or improved by preventing overgrazing, controlling weeds, and protecting the areas from fire. Additions of plant food and prevention of overgrazing improve the quality and quantity of tame pasture and protect the soil from erosion. Capability unit VIe-1; Blackclay Prairie range site; not assigned to woodland group.

Karma Series

The Karma series consists of very gently sloping to moderately steep soils on uplands. These soils formed in material weathered from loamy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is dark brown fine sandy loam 11 inches thick. The upper part of the subsoil is red clay loam 19 inches thick, the middle part is yellowish red sandy clay loam 22 inches thick, and the lower part is yellowish red fine sandy loam to a depth of 65 inches.

Karma soils are well drained and have moderate permeability. Available water capacity is high. The water table is at a depth of more than 6 feet.

Representative profile of Karma fine sandy loam, 1 to 3 percent slopes, 1,550 feet east and 150 feet south of the northwest corner of sec. 18, T. 8 S., R. 15 E.:

Ap—0 to 11 inches; dark brown (7.5YR 4/4) fine sandy loam, light brown (7.5YR 6/4) dry; weak fine granular structure; hard, very friable; slightly acid; gradual smooth boundary.

B21t—11 to 30 inches; red (2.5YR 4/6) clay loam, red (2.5YR 5/6) dry; moderate fine and medium subangular blocky structure; hard, firm; nearly continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—30 to 52 inches; yellowish red (5YR 4/6) sandy clay loam, yellowish red (5YR 5/6) dry; moderate fine and medium subangular blocky structure; hard, firm; nearly continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B3—52 to 65 inches; yellowish red (5YR 5/6) fine sandy loam, reddish yellow (5YR 6/6) dry; weak fine and medium subangular blocky structure; slightly hard, friable; few clay films bridging sand grains; medium acid.

Depth to bedrock is more than 60 inches. The solum is 40 inches to more than 60 inches thick. It ranges from medium acid to mildly alkaline. The A1 or Ap horizon is very dark grayish brown, dark brown, brown, or reddish brown. The B2t horizon is reddish brown, yellowish red, or red. It is sandy clay loam or clay loam. The B3 horizon is reddish brown, yellowish red, or red. It is fine sandy loam, loam, or sandy clay loam. In some profiles there is a C horizon that is reddish brown, yellowish red, or red. It has strata of loamy fine sand to sandy clay loam.

42—Karma fine sandy loam, 1 to 3 percent slopes. This soil is very gently sloping. It has the profile described as representative of the series. Included with this soil in mapping are 10 percent areas of Okay soils; 5 percent areas of a soil that has a profile similar to this Karma soil, but the subsoil is more than 60 inches thick; and 5 percent areas of an eroded soil that has a surface layer about 6 inches thick.

This soil is used mostly for peanuts, grain sorghum, soybeans, wheat, and cotton. A sizable acreage is used for tame pasture and woodland. This soil is also suited to native grasses.

The main concerns in management are controlling the hazard of erosion and maintaining tilth and fertility. Terracing needs to be used where the soil is eroded. Additions of plant food increase plant growth and provide more crop residue to help maintain tilth and fertility. Contour farming on areas of sloping soils, stripcropping, and using crop residue help to control erosion. In areas of row crops, winter cover crops furnish additional protection against soil blowing and erosion. Minimum tillage needs to be used. Capability unit IIe-2; Loamy Savannah range site; woodland group 3o.

43—Karma fine sandy loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to the one described as representative of the series, but the surface layer is about 9 inches thick. Included with this soil in mapping and each making up about 5 percent of the mapped area are Boxville soils; Larton soils; and a soil in eroded areas that has a profile similar to the one described as representative of the series, but the surface layer is about 4 inches thick and is mixed with material from the subsoil.

This soil is used mostly for tame pasture, wheat, grain sorghum, peanuts, soybeans, and cotton. A small acreage is used for woodland and native grasses.

The main concerns in management are controlling erosion and maintaining tilth and fertility. A large amount of crop residue needs to be returned to the soil and plant food needs to be added to help maintain tilth and fertility. High residue crops such as wheat need to be dominant in the cropping system where row crops are grown. Terracing, contour farming, and using crop residue help to control erosion. Capability unit IIIe-4; Loamy Savannah range site; woodland group 3o.

44—Karma fine sandy loam, 2 to 5 percent slopes, eroded. This soil is very gently sloping to gently sloping and is eroded. It has a profile similar to the one described as representative of the series, but the surface layer is about 4 inches thick and is mixed with material from the subsoil in about 40 percent of the area. Gullies are 1 foot to 5 feet deep, 5 to 12 feet wide, and about 300 feet apart. Rills are common. Included with this soil in mapping are about 5 percent Boxville soils and 5 percent Larton soils.

This soil is used mostly for tame pasture. The main cultivated crop is wheat. This soil is also suited to native grasses and trees.

The main concerns in management are maintaining tilth and fertility and protecting the soil from erosion. Using a cropping system of small grain and adding plant food that provides for maximum residue are needed to control further erosion. Terraces, waterways, and contour farming are necessary to reduce the rate of erosion. In a few areas, gullies need to be shaped and put into permanent vegetation. Row crops should be avoided to prevent excessive erosion. Native grasses or tame pasture and legumes and additions of plant food will reduce erosion. Capability unit IIIe-5; Loamy Savannah range site; woodland group 3o.

45—Karma fine sandy loam, 8 to 20 percent slopes. This soil is strongly sloping to moderately steep. It has a profile similar to the one described as representative of the series, but the surface layer is about 6 inches thick. Included with this soil in mapping and making up about 10 percent of the mapped acreage are areas of Boxville and Larton soils. Also included and making up 10 percent of the mapped area are areas of soils that have a profile similar to the one described as representative of the series but are steeply sloping or have a surface layer of fine sandy loam, sandy clay loam, or clay loam.

This soil is used mostly for native grasses or woodland. Some areas of this soil are used for tame pasture.

The main concerns of management are preventing erosion and maintaining tilth. Proper management of native grasses, woodlands, and tame pasture will maintain tilth and reduce erosion. Preventing overgrazing, controlling brush, and protecting the areas from fire improve the quality and quantity of native grasses. The wooded areas can be improved by removing or controlling inferior species, planting suitable species, selectively harvesting trees on a planned schedule, and protecting the areas from fire. Adding plant food and preventing overgrazing improve tame pasture and help to control erosion. Capability unit VIe-3; Loamy Savannah range site; woodland group 3o.

Kaufman Series

The Kaufman series consists of nearly level soils on flood plains. These soils formed in material weathered from clayey sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is very dark gray clay 8 inches thick. Below this is black clay 40 inches thick. The next layer is very dark gray clay to a depth of 62 inches.

Kaufman soils are somewhat poorly drained and have very slow permeability. Available water capacity is medium. The water table in most areas is at a depth of 0 to 3.5 feet for brief periods during November through April. Kaufman soils are subject to flooding.

Representative profile of Kaufman clay, 1,580 feet south and 300 feet east of the northwest corner of sec. 7, T. 7 S., R. 11 E.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate very fine granular structure; very hard, firm; mildly alkaline; gradual smooth boundary.

A11—8 to 24 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine granular and subangular blocky structure; very hard, firm; mildly alkaline; gradual smooth boundary.

AC1g—24 to 48 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine granular and subangular blocky structure; very hard, very firm; few small iron and manganese concretions; few small pressure faces on peds; mildly alkaline; gradual smooth boundary.

AC2g—48 to 62 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, very firm; slickensides about 1 inch in diameter that do not intersect; mildly alkaline.

The depth to bedrock is more than 60 inches. Cracks are prevalent during dry weather. The solum ranges from medium acid to mildly alkaline and is typically noncalcareous, but some profiles are calcareous below a depth of 24 inches. The A1 or Ap horizon is very dark gray or black. The ACg horizon is black, very dark gray, dark gray, or gray and has yellowish, black, red, brownish, and olive mottles in some profiles.

46—Kaufman clay. This soil is nearly level and is subject to occasional flooding. It has a profile described as representative of the series. Included with this soil in mapping are less than 3 percent areas of Gowton soils and less than 5 percent areas of Verdigris soils.

This soil is used mostly for tame pasture. A small acreage is used for grain sorghum, soybeans, wheat, and cotton. This soil is also suited to trees.

The main concerns in management in cultivated areas are controlling occasional flooding and surface wetness, increasing water intake, and maintaining tilth. Close-grown crops are needed late in fall, in winter, and in spring to prevent excessive erosion during flooding. Planting in spring needs to be delayed until after the period of common flooding. Most crops can be grown continuously where plant food is added that provides for maximum crop residue. A

large amount of residue helps maintain organic matter and improves tilth and intake of water. Where this soil is wet, tillage or grazing breaks down tilth and reduces water intake. A drainage system coupled with arranging rows for drainage reduces surface wetness for better crops. Capability unit IIw-4; not assigned to range site; woodland group 2w.

47—Kaufman clay, depressional. This soil is nearly level in depressional areas, and it is subject to frequent flooding. It has a profile similar to the one described as representative of the series, but the profile is mottled in shades of black, gray, brown, and red in the lower part. Included with this soil in mapping and making up about 15 percent of the mapped acreage are soils that are similar to the one described as representative for the series, but the surface layer and underlying layers are less than 24 inches thick.

This soil is used mainly for tame pasture and woodland. A few small areas are used for wildlife habitat.

The main concerns in management are controlling surface wetness, ponding, and frequent flooding and maintaining tilth and water intake. Wet and ponded areas can be established to water-tolerant grasses. Where needed and practical, simple drainage systems help the establishment and production of tame pasture. Production of tame pasture can be increased by adding plant food and preventing overgrazing. A good grass mulch helps to maintain tilth and improves intake of water. In woodland areas thinning, weeding, selective cutting, and protecting the areas from fire will improve the quality of trees. Capability unit Vw-1; not assigned to range site; woodland group 3w.

Kiomatia Series

The Kiomatia series consists of nearly level soils on flood plains. These soils formed in material weathered from sandy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is reddish brown very fine sandy loam 4 inches thick. The next layer is reddish brown fine sand 9 inches thick. The next layer is light reddish brown very fine sandy loam and reddish brown fine sandy loam 3 inches thick. The underlying material is reddish brown fine sand to a depth of 60 inches.

Kiomatia soils are well drained and have rapid permeability. Available water capacity is low. The depth to the water table is 3 to 5 feet during January through July. Kiomatia soils are subject to flooding.

Representative profile of Kiomatia very fine sandy loam, in an area of Kiomatia soils, 2,480 feet west and 800 feet south of the northeast corner of sec. 20, T. 9 S., 11 E.:

A1—0 to 4 inches; reddish brown (5YR 4/4) very fine sandy loam, reddish brown (5YR 5/4) dry; weak thin platy and granular structure; slightly hard, friable; organic stains in root channels; calcareous, moderately alkaline; clear smooth boundary.

C1—4 to 13 inches; reddish brown (5YR 5/4) fine sand, light reddish brown (5YR 6/4) dry; single grained; soft, very friable; common strata of loamy fine sand and fine sandy loam; calcareous; moderately alkaline; clear smooth boundary.

C2—13 to 16 inches; stratified light reddish brown (5YR 6/4) very fine sandy loam and reddish brown (5YR 5/4) fine sandy loam; pink (5YR 7/3) and light reddish brown (5YR 6/4) dry; weak thin and medium platy and granular structure; hard, firm; calcareous, moderately alkaline; clear smooth boundary.

C3—16 to 60 inches; reddish brown (5YR 5/4) fine sand, pink (5YR 7/3) dry; single grained; loose dry or moist; few thin strata as much as 1 inch thick of darker loam; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. The A1 or Ap horizon ranges from reddish brown to light reddish brown. It ranges from loamy fine sand to silty clay loam. The C horizon is light reddish brown, pink, or reddish brown. Between depths of 10 and 40 inches, it is mainly fine sand or loamy fine sand and a few thin strata of loamy very fine sand or finer textured material.

48—Kiomatia fine sandy loam. This soil is nearly level and is subject to rare flooding. It has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam. Included with this soil in mapping are less than 15 percent areas of Oklared soils and less than 5 percent of Severn soils. Also included are about 5 percent hummocky soils that have a profile similar to that described as representative for the series but have a surface layer of fine sand.

This soil is suited to tame pasture, wheat, peanuts, grain sorghum, soybeans, and cotton. Some areas are managed for woodland.

The main concerns in management are controlling rare flooding and erosion and maintaining tilth and fertility. Additions of plant food help to produce a large amount of crop residue and maintain organic matter, tilth, and fertility. Stripcropping helps to control soil blowing. A winter cover crop is needed where this soil is in row crops. Capability unit IIIs-1; not assigned to range site; woodland group 2o.

49—Kiomatia complex. This complex consists of about 50 percent Kiomatia soils, 45 percent soils that have a profile similar to the one described as representative of the Kiomatia series but that are fine sand throughout, and 5 percent Oklared soils. These soils are in such an intricate pattern that it was not practical to separate them in mapping.

The Kiomatia soils in this complex are nearly level and rarely flooded and are in interdune positions. These soils have a profile similar to the one described as representative of the series, but the surface layer is silty clay loam.

The fine sand soils in this complex are very gently sloping to strongly sloping and are on side slopes and crests of low dunes.

The soils in this complex are suited to tame pasture, wheat, peanuts, grain sorghum, soybeans, and cotton. Some areas are managed for woodland.

The main concerns in management are controlling rare flooding and soil blowing and maintaining tilth and fertility. Additions of plant food help to produce a large amount of crop residue and maintain organic matter, tilth, and fertility. Stripcropping close-growing crops with row crops perpendicular to the prevailing wind direction helps to control soil blowing. A winter cover crop is needed where this soil is in row

crops. Capablity unit IIIs-1; not assigned to range site; woodland group 3s.

50—Kiomatia soils. These soils are nearly level and are subject to frequent flooding. A Kiomatia soil that has a profile described as representative of the series is in areas of these soils, but in places these soils have a surface layer of loamy fine sand and fine sandy loam. Included with these soils in mapping are less than 5 percent areas of Oklared and Norwood soils. Also included and making up about 10 percent of the mapped acreage is a soil that has a profile similar to the one described as representative of the series, but the surface layer and underlying layers are fine sand.

These soils are used mostly for tame pasture. A few areas are managed for woodland.

The main concerns in management are controlling frequent flooding and maintaining tilth. Production of tame pasture can be increased by adding plant food, preventing overgrazing, and controlling brush. A good grass mulch can be maintained by protecting the area from fire. A grass mulch will improve tilth and protect the soil from erosion during floods. In woodland areas the quality of trees is improved by weeding, thinning, selective cutting, and protecting the areas from fire. Capability unit Vw-2; not assigned to range site; woodland group 2o.

Larton Series

The Larton series consists of very gently sloping to gently sloping soils on uplands. These soils formed in material weathered from sandy and loamy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is dark brown loamy fine sand 9 inches thick. The subsurface layer is brown loamy fine sand 16 inches thick. The upper part of the subsoil is red fine sandy loam 6 inches thick; the middle part is yellowish red fine sandy loam 29 inches thick; and the lower 13 inches is yellowish red, red, and pale brown sandy clay loam.

Larton soils are well drained and have moderate permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Larton loamy fine sand, 1 to 3 percent slopes, 2,210 feet east and 60 feet north of the southwest corner of sec. 2, T. 8 S., R. 7 E.:

Ap—0 to 9 inches; dark brown (7.5YR 4/4) loamy fine sand, light brown (7.5YR 6/4) dry; single grained; loose dry or moist; slightly acid; abrupt smooth boundary.

A2—9 to 25 inches; brown (7.5YR 5/4) loamy fine sand, light brown (7.5YR 6/4) dry; weak fine granular structure; slightly hard, friable; few organic stains; medium acid; clear wavy boundary.

B21t—25 to 31 inches; red (2.5YR 5/6) fine sandy loam, light red (2.5YR 6/6) dry; weak medium prismatic structure and moderate medium subangular blocky; hard, friable; thin nearly continuous clay films on faces of peds and bridging sand grains; organic stains in few root channels; few streaks of material from A horizon; medium acid; gradual smooth boundary.

B22t—31 to 48 inches; yellowish red (5YR 5/6) fine sandy loam, reddish yellow (5YR 6/6) dry; moderate medium subangular blocky structure; hard, friable; thin nearly continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B23t—48 to 60 inches; yellowish red (5YR 5/6) fine sandy loam, reddish yellow (5YR 6/6) dry; weak medium subangular blocky structure; hard, friable; thin patchy clay films on faces of peds; few organic stains; few bodies of clean sand grains; medium acid; gradual smooth boundary.

B24t—60 to 73 inches; mottles and bodies of yellowish red (5YR 5/6), red (2.5YR 5/6), and pale brown (10YR 6/3) sandy clay loam; weak coarse subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; few bodies of clean sand grains; organic stains in root channels; slightly acid.

The solum is more than 60 inches thick. The Al or Ap horizon is very dark grayish brown, brown, dark brown, dark yellowish brown, dark grayish brown, grayish brown, yellowish brown, light brownish gray, pale brown, light yellowish brown, very pale brown, pinkish gray, light brown, or pink. The A2 horizon ranges from brown to pink. The A horizon ranges from slightly acid to medium acid. The B21t, B22t, and B23t horizons are strong brown, yellowish red, reddish yellow, or red. They are fine sandy loam or loam and range from medium acid to strongly acid. In some profiles the B23t horizon lacks pockets of clean sand grains in the lower part. The B24t horizon is strong brown to red and ranges from slightly acid to strongly acid. It is 2 to 10 percent pockets of clean sand grains.

51—Larton loamy fine sand, 1 to 3 percent slopes. This soil is very gently sloping (fig. 3). It has a profile described as representative of the series. Included

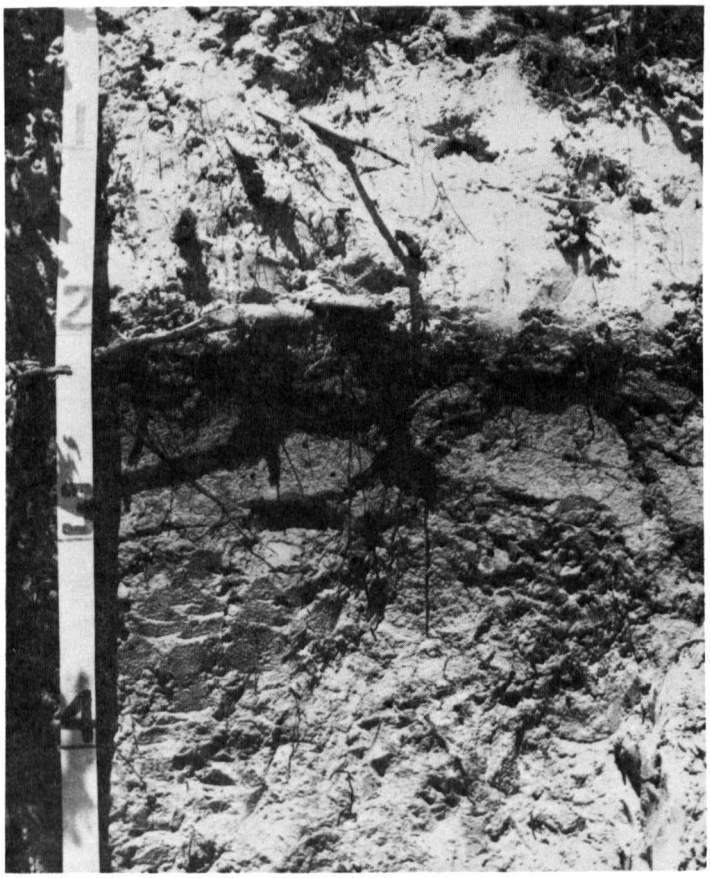

Figure 3.—**Profile of Larton loamy fine sand, 1 to 3 percent slopes.**

with this soil in mapping are about 5 percent areas of Eufaula soils and 20 percent areas of a soil that has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsurface layer is less than 20 inches.

This soil is used mostly for tame pasture. Some areas are managed for woodland. The main crops under cultivation are grain sorghum, peanuts, wheat, and soybeans.

The main concerns in management are controlling erosion and maintaining fertility. Most crops that produce a large amount of plant residue can be grown continuously where the residue is returned to the soil. Additions of plant food increase plant growth and provide more residue to reduce the hazard of soil blowing. Stripcropping and planting winter cover crops furnish additional protection in areas that are in row crops. Crops that provide a low amount of plant residue should not be in the cropping system for more than 3 years in succession. Capability unit IIIe-1; not assigned to range site; woodland group 3o.

52—Larton loamy fine sand, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsurface layer is about 27 inches. Included with this soil in mapping and making up less than 30 percent of the mapped acreage are areas of soils that have a profile similar to the one described as representative of the Larton series, but the combined thickness of the surface layer and subsurface layer is less than 20 inches.

This soil is used mostly for tame pasture. Sizable areas are managed for woodland. The main crops under cultivation are grain sorghum, peanuts, wheat, and soybeans.

The main concerns in management are controlling erosion and maintaining fertility. Most crops that produce a large amount of plant residue can be grown continuously where the residue is returned to the soil. The addition of plant food increases plant growth and provides more plant residue to reduce the hazard of soil blowing. In areas in row crops, stripcropping and planting winter cover crops furnish additional soil protection. Crops that produce a low amount of plant residue should not be grown 2 years in succession. Capability unit IVe-1; not assigned to range site; woodland group 3o.

Larue Series

The Larue series consists of nearly level to very gently sloping soils on uplands. These soils formed in material weathered from sandy and loamy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is brown loamy fine sand 11 inches thick. The subsurface layer is light yellowish brown loamy fine sand 15 inches thick. The upper part of the subsoil is strong brown sandy clay loam 20 inches thick, the middle part is strong brown loam 14 inches thick, and the lower part is reddish yellow loam 14 inches thick.

Larue soils are well drained and have moderate permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Larue loamy fine sand, 0 to 3 percent slopes, 1,050 feet east and 250 feet south of the northwest corner of sec. 8, T. 6 S., R. 13 E.:

A1—0 to 11 inches; brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; weak very fine granular structure; soft, very friable; organic staining in some parts; slightly acid; gradual smooth boundary.

A2—11 to 26 inches; light yellowish brown (10YR 6/4) loamy fine sand, very pale brown (10YR 7/3) dry; weak very fine granular structure; soft, very friable; few organic stains; some sand grains not clean; slightly acid; clear smooth boundary.

B21t—26 to 46 inches; strong brown (7.5YR 5/6) sandy clay loam, reddish yellow (7.5YR 6/6) dry; weak medium prismatic structure and weak fine subangular blocky; hard, firm; streaks of clean sand grains; clay films coating sand grains and faces of peds; some organic staining; medium acid; gradual smooth boundary.

B22t—46 to 60 inches; strong brown (7.5YR 5/6) loam, reddish yellow (7.5YR 7/6) dry; weak medium prismatic structure and subangular blocky; slightly hard, friable; about 6 percent streaks of clean sand grains; clay films coating most sand grains and faces of peds; medium acid; gradual smooth boundary.

B3—60 to 74 inches; reddish yellow (5YR 6/6) loam, reddish yellow (5YR 7/6) dry; weak coarse prismatic structure; slightly hard, very friable; 10 percent skeletons; clay films bridging sand grains and faces of peds; medium acid.

The solum is more than 60 inches thick. The A1 or Ap horizon is 20 to 40 inches thick. It is brown, dark brown, or pale brown. The A2 horizon is light yellowish brown, brown, or strong brown. The A horizon ranges from slightly acid to medium acid. The B2t horizon is strong brown, reddish yellow, yellowish red, or red. In some profiles it has mottles in shades of brown, yellow, or red. It is loam, sandy clay loam, or clay loam and ranges from slightly acid to medium acid. The B3 horizon is strong brown to red. It is loam, sandy clay loam, or clay loam. It is slightly acid to medium acid.

53—Larue loamy fine sand, 0 to 3 percent slopes. This soil is nearly level to very gently sloping. Included with this soil in mapping and making up 15 percent of the mapped acreage are areas of Bernow soils.

This soil is used mostly for tame pasture. Sizable areas are managed for woodland. The main crops under cultivation are grain sorghum, peanuts, wheat, and soybeans.

The main concerns in management are controlling erosion and maintaining fertility. Most crops that produce a large amount of plant residue can be grown continuously where the residue is returned to the soil. Addition of plant food increases plant growth and provides more plant residue to reduce the hazard of soil blowing. In areas in row crops, stripcropping and planting winter cover crops furnish additional soil protection. Crops that produce a low amount of plant residue should not be grown more than 3 years in succession. Capability unit IIIs-2; Sandy Savannah range site; woodland group 3s.

Madill Series

The Madill series consists of nearly level soils on flood plains. These soils formed in material weathered

from loamy and sandy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is brown fine sandy loam 16 inches thick. The next layer is dark brown fine sandy loam 14 inches thick. The underlying material is reddish brown loam to a depth of 68 inches.

Madill soils are well drained and have moderately rapid permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet. These soils are subject to flooding.

Representative profile of Madill fine sandy loam, 1,680 feet east and 150 feet north of the southwest corner of sec. 20, T. 6 S., R. 12 E.:

A1—0 to 16 inches; brown (10YR 4/3) fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; soft, friable; organic stains in some root channels; slightly acid; clear smooth boundary.

C1—16 to 30 inches; dark brown (7.5YR 4/4) fine sandy loam; light brown (7.5YR 6/4) dry; massive; slightly hard, friable; few thin strata of dark yellowish brown (10YR 4/4) loam; organic stains in pores; slightly acid; clear smooth boundary.

C2—30 to 48 inches; reddish brown (5YR 4/4) loam, reddish brown (5YR 5/4) dry; massive; slightly hard, friable; few thin strata of dark reddish brown (5YR 3/2) loam; medium acid; clear smooth boundary.

C3—48 to 68 inches; reddish brown (5YR 5/4) loam, light reddish brown (5YR 6/4) dry; massive; hard, friable; few thin strata of dark reddish brown (5YR 3/4) loam; medium acid.

Depth to bedrock is more than 60 inches; reaction is medium acid to neutral at a depth of less than 40 inches and medium acid to moderately alkaline at a depth of more than 40 inches. The A1 or Ap horizon is very dark grayish brown, dark grayish brown, dark brown, brown, dark reddish brown, and reddish brown. The C horizon is brown, dark brown, strong brown, reddish brown, or yellowish red. It is fine sandy loam or loam. Thin strata of coarser textured or fine textured material occur throughout the C horizon.

54—Madill fine sandy loam. This soil is nearly level and is subject to occasional flooding. Included with this soil in mapping are about 10 percent areas of Gowton soils.

This soil is used mostly for tame pasture, grain sorghum, wheat, soybeans, cotton, peanuts, and alfalfa hay. Sizable areas are managed for woodland.

The main concerns in management are controlling occasional flooding and maintaining tilth. Close-grown crops are needed late in fall, in winter, and in spring to prevent excessive erosion during flooding. Planting in spring needs to be delayed until after the period of common flooding. Most crops that produce a large amount of residue can be grown continuously where plant food is added that provides for maximum crop residue. Maintaining the organic matter content of this soil improves tilth and intake of water. Minimum tillage needs to be used. Tame pasture or woodland protects this soil during flooding. Capability unit IIw-2; not assigned to range site; woodland group 2o.

Matoy Series

The Matoy series consists of very gently sloping soils on uplands. These soils formed in material weathered from loamy and clayey sediment and limestone under a cover of grasses.

In a representative profile the surface layer is very dark brown silty clay loam 10 inches thick. The upper part of the subsoil is dark brown and brown silty clay loam 14 inches thick, the middle part is brown silty clay 7 inches thick, and the lower part is olive brown gravelly silty clay 7 inches thick. It is underlain by hard limestone bedrock that is not rippable.

Matoy soils are well drained and have slow permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Matoy silty clay loam, 1 to 3 percent slopes, 860 feet west and 1,320 feet south of the northeast corner of sec. 15, T. 5 S., R. 10 E.:

A1—0 to 10 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; hard, firm; neutral; gradual smooth boundary.

B21—10 to 14 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 4/3) dry; moderate fine and medium subangular blocky structure; hard, firm; nearly continuous clay films on faces of peds; few organic stains on faces of peds; few limestone fragments; neutral; gradual smooth boundary.

B22—14 to 24 inches; brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; moderate fine and medium blocky structure; hard, firm; nearly continuous clay films on faces of peds; few organic stains on faces of peds; few fine concretions; few fine limestone fragments; neutral; gradual smooth boundary.

B23—24 to 31 inches; brown (10YR 4/3) silty clay, pale brown (10YR 6/3) dry; moderate fine and medium blocky structure; very hard, very firm; nearly continuous clay films on faces of peds; few organic stains; few slickensides that do not intersect; few fine limestone fragments and concretions; mildly alkaline; gradual smooth boundary.

Bca—31 to 38 inches; olive brown (2.5Y 4/4) gravelly silty clay, light olive brown (2.5Y 5/4) dry; weak fine blocky structure; very hard, very firm; patchy clay films on faces of peds; common fine lime concretions; few sea shells; few limestone fragments; calcareous; moderately alkaline; clear wavy boundary.

R—38 to 40 inches; limestone bedrock.

Solum thickness and depth to bedrock range from 20 to 40 inches. Depth to lime ranges from 12 to 36 inches. The A1 or Ap horizon is very dark gray, very dark brown, black, or very dark grayish brown. It ranges from slightly acid to mildly alkaline. The B2 horizon is dark brown, brown, dark grayish brown, dark yellowish brown, light olive brown, grayish brown, or olive brown. It is silty clay loam, silty clay, or clay and ranges from neutral to moderately alkaline. The Bca horizon is light brownish gray, light gray, grayish brown, pale brown, brown, yellowish brown, or olive brown. It is clay, silty clay, or silty clay loam, and gravel makes up 2 to 20 percent of the horizon. The Bca horizon ranges from mildly alkaline to moderately alkaline.

55—Matoy silty clay loam, 1 to 3 percent slopes. This soil is very gently sloping. Included with this soil in mapping are areas of Tarrant, Durant, and San Saba soils that each make up less than 5 percent of the mapped acreage.

This soil is used mostly for cotton, grain sorghum, soybeans, wheat, and tame pasture. A few areas are in native grass.

The main concerns in management are controlling erosion and surface crusting, increasing water intake, and maintaining tilth. The cropping system should

include crops that produce a large amount of crop residue. Low-residue crops, such as cotton, need to be rotated with high residue crops about one-half of the time. The addition of plant food to produce crop residue maintains organic matter, improves tilth, increases water intake, and prevents surface crusting. Terracing, contour farming, and using cover crops are especially needed where row crops are grown. Capability unit IIe-3; Blackclay Prairie range site; not assigned to woodland group.

Muldrow Series

The Muldrow series consists of nearly level soils on flood plains. These soils formed in material weathered from clayey sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is very dark gray silty clay loam 10 inches thick. The upper part of the subsoil is black clay 16 inches thick, the middle part is very dark grayish brown silty clay loam 55 inches thick, and the lower part is brown silty clay loam to a depth of 64 inches.

Muldrow soils are somewhat poorly drained and have very slow permeability. Available water capacity is medium. Depth to the water table ranges from 0 to 2 feet during November through March. Muldrow soils are subject to flooding.

Representative profile of Muldrow silty clay loam, 500 feet east and 500 feet south of the northwest corner of sec. 16, T. 9 S., R. 10 E.:

A1—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate medium granular structure; hard, firm; medium acid; gradual smooth boundary.

B21tg—10 to 26 inches; black (10YR 2/1) clay, dark gray (10YR 4/1) dry; moderate coarse blocky structure; very hard, very firm; clay films on faces of peds; neutral; gradual smooth boundary.

B22tg—26 to 37 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry, moderate coarse blocky structure; very hard, very firm; clay films on faces of peds; neutral; gradual smooth boundary.

B3g—37 to 64 inches; brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; weak coarse blocky structure; very hard, very firm; few clay films on faces of peds; few fine gypsum crystals; moderately alkaline.

The depth to bedrock is more than 60 inches. The A1 or Ap horizon is very dark brown, very dark grayish brown, very dark gray, or black. It ranges from medium acid to neutral in limed areas. The B2tg horizon is very dark brown, very dark grayish brown, dark gray, very dark gray, dark grayish brown, or black. It has brownish or grayish mottles. It is clay, silty clay, or silty clay loam and ranges from slightly acid to neutral. The B3g horizon is dark gray, gray, dark grayish brown, grayish brown, dark brown, or brown. It is clay, silty clay, or silty clay loam. The B3 horizon ranges from neutral to moderately alkaline.

56—Muldrow silty clay loam. This soil is nearly level and is subject to rare flooding. Included with this soil in mapping are 15 percent areas of soils that have a profile similar to the one described as representative of the series, but the surface layer is gray and light gray loamy fine sand or it is about 30 inches thick on mounds that are 1 foot to 4 feet high and 30 to 100 feet in diameter. Also included are about 5 percent areas of soils in old sloughs and channels that are ponded for 1 week to 3 weeks after flooding.

This soil is used mostly for tame pasture. A small acreage is used for grain sorghum, wheat, soybeans, and cotton. Some areas are managed for woodland.

The main concerns in management are controlling rare flooding and surface wetness, increasing water intake, and maintaining tilth and fertility. Most crops can be grown continuously where plant food is added that provides for maximum crop residue. A large amount of residue helps to maintain organic matter and improves tilth, fertility, and intake of water. Where this soil is wet, tillage or grazing breaks down tilth and reduces water intake. Close-grown crops are needed during periods of flooding to prevent excessive erosion. A surface drainage system is needed in areas that are ponded. Capability unit IIw-1; not assigned to range site; woodland group 2w.

Muskogee Series

The Muskogee series consists of nearly level to gently sloping soils on uplands. These soils formed in material weathered from loamy and clayey sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is brown silt loam 8 inches thick. The subsurface layer is brown silt loam 3 inches thick. The upper part of the subsoil is light yellowish brown silty clay loam 15 inches thick, the middle part is strong brown silty clay loam 16 inches thick, and the lower part is light brownish gray silty clay 20 inches thick.

Muskogee soils are moderately well drained and have slow permeability. Available water capacity is high. Depth to the water table is more than 6 feet.

Representative profile of Muskogee silt loam, 1 to 3 percent slopes, 1,560 feet east and 1,360 feet south of the northwest corner of sec. 21, T. 8 S., R 10 E.:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; slightly hard, very friable; medium acid; clear smooth boundary.

A2—8 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; few fine yellowish brown mottles; weak fine granular structure; hard, friable; medium acid; clear smooth boundary.

B1—11 to 26 inches; light yellowish brown (10YR 6/4) silty clay loam, very pale brown (10YR 7/4) dry; common medium reddish yellow (7.5YR 6/6) mottles; weak fine and medium subangular blocky structure; hard, friable; thin patchy clay films; few fine iron concretions; strongly acid; gradual smooth boundary.

B21t—26 to 42 inches; strong brown (7.5YR 5/6) silty clay loam, reddish yellow (7.5YR 6/6) dry; common medium distinct grayish brown (10YR 5/2) and few medium distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; clay films on faces of peds; organic stains in root channels; medium acid; gradual smooth boundary.

B22t—42 to 62 inches; light brownish gray (10YR 6/2) silty clay, light gray (10YR 7/2) dry; many medium and coarse strong brown (7.5YR 5/6) mottles; weak medium prismatic structure and subangular blocky;

hard, firm; clay films on faces of peds; organic stains on some peds; mildly alkaline.

The depth to bedrock is more than 60 inches. The A1 or Ap horizon is dark grayish brown, brown, or grayish brown. The A2 horizon is grayish brown, brown, light brownish gray, pale brown, light yellowish brown, or yellowish brown. The A horizon ranges from medium acid to strongly acid. The B1 horizon is yellowish brown or light yellowish brown. It is a silt loam or silty clay loam and ranges from strongly acid to medium acid. The B21t horizon is yellowish brown or strong brown and has grayish and reddish mottles at a depth of about 30 inches. The B21t horizon ranges from strongly acid to medium acid. The B22t horizon is light brownish gray or light gray and is mottled in shades of red, yellow, and brown. It ranges from medium acid to mildly alkaline.

57—Muskogee silt loam, 0 to 1 percent slopes. This soil is nearly level. It has a profile similar to the one described as representative for the series, but the combined thickness of the surface layer and subsurface layer is about 10 inches. Included with this soil in mapping are about 5 percent areas of Durant soils and 10 percent areas of Dennis soils.

This soil is used mostly for soybeans, wheat, grain sorghum, peanuts, cotton, and alfalfa hay. Tame pasture is grown in some areas. This soil is also suited to native grasses and trees.

The main concerns in management are controlling erosion on long slopes and maintaining tilth and fertility. This soil can be used continuously for clean-tilled crops if plant food is added and crop residue is returned to the soil. Proper management of crop residue helps maintain tilth and improves water intake. On a few long slopes, diversion terraces are used to prevent excessive sheet erosion. Capability unit I-2; Loamy Savannah range site; woodland group 3o.

58—Muskogee silt loam, 1 to 3 percent slopes. This soil is very gently sloping (fig. 4). It has a profile described as representative of the series. Included with this soil in mapping are about 10 percent areas of Dennis soils and 5 percent areas of Durant soils.

This soil is used mostly for peanuts, grain sorghum, soybeans, wheat, or cotton. A sizable acreage is used for tame pasture and woodland. This soil is also suited to native grasses.

The main concerns in management are controlling the hazard of erosion and maintaining tilth and fertility. Terracing needs to be used where the soil is eroded. Addition of plant food increases plant growth and provides crop residue to help maintain tilth and fertility. Contour farming on sloping areas, strip-cropping, and using crop residue help to control erosion. In areas in row crops, winter cover crops furnish protection against soil blowing and erosion. Minimum tillage needs to be used. Capability unit IIe-2; Loamy Savannah range site; woodland group 3o.

59—Muskogee silt loam, 3 to 5 percent slopes. This soil is gently sloping. It has a profile similar to the one described as representative of the series, but the surface layer is about 8 inches thick. Included with this soil in mapping are less than 5 percent areas of Durant soils, less than 5 percent areas of Bernow soils, and less than 10 percent areas of Dennis soils. Also included are about 5 percent areas of eroded soil that has a profile similar to the one described as representative of the series, but the surface layer is about 4 inches thick and is mixed with material from the subsoil.

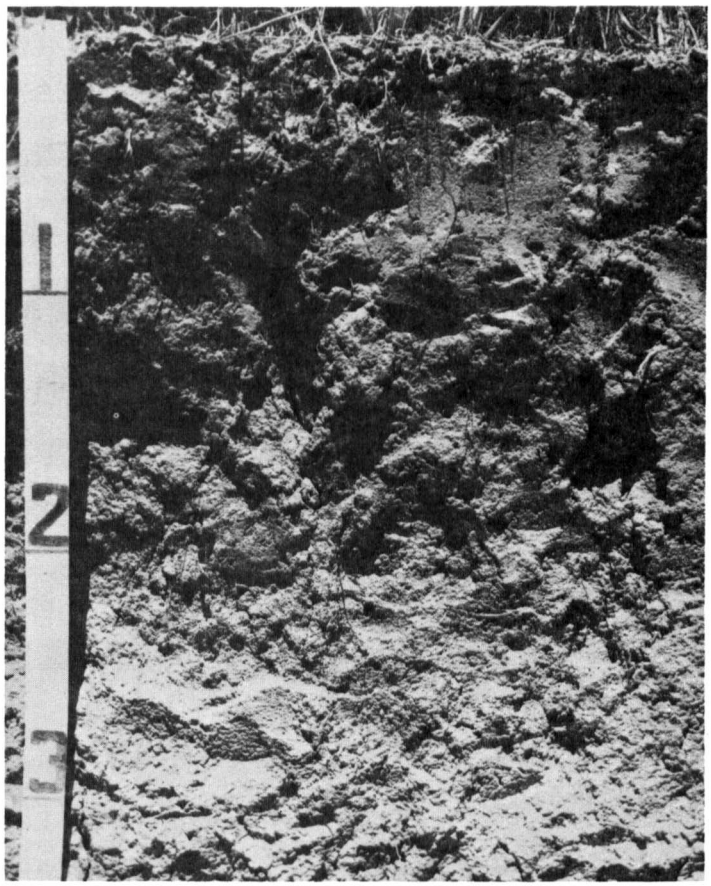

Figure 4.—Profile of Muskogee silt loam, 1 to 3 percent slopes.

This soil is used mostly for tame pasture, wheat, grain sorghum, peanuts, soybeans, and cotton. A small acreage is used for woodland. This soil is also suited to native grasses.

The main concerns in management are controlling the hazard of erosion and maintaining tilth and fertility. A large amount of crop residue needs to be returned to the soil and plant food added to help maintain tilth and fertility. High-residue crops such as wheat need to be dominant in the cropping system where row crops are grown. Terracing, contour farming, and using crop residue help to control erosion. Capability unit IIIe-4; Loamy Savannah range site; woodland group 3o.

60—Muskogee silt loam, 2 to 5 percent slopes, eroded. This soil is very gently sloping to gently sloping and is eroded. It has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsurface layer is about 6 inches and these layers are mixed with material from the subsoil in a spotty pattern in about 50 percent of the area. Rills are common throughout

the area, and shallow gullies 1 foot to 5 feet deep occur about 300 feet apart. Included with this soil in mapping are areas of Dennis, Parsons, and Karma soils, each making up about 5 percent of the mapped acreage.

This soil is used mostly for tame pasture. The main cultivated crop is wheat. This soil is also suited to native grasses and trees.

The main concerns in management are maintaining tilth and fertility and protecting the soil from erosion. A cropping system using small grain and amounts of plant food that provide for maximum residue is needed to control further erosion. Terraces, waterways, and contour farming are necessary to reduce the rate of erosion. In a few areas, gullies need to be shaped and put into permanent vegetation. Row crops should be avoided to prevent excessive erosion. Native grasses or tame pasture grasses and legumes and additions of plant food help to reduce erosion. Capability unit IIIe-5; Loamy Savannah range site; woodland group 3o.

Norwood Series

The Norwood series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is 9 inches of dark reddish brown silt loam underlain by 16 inches of dark reddish brown silty clay loam. The underlying material is dark reddish brown silty clay loam to a depth of 60 inches.

Norwood soils are well drained and have moderate permeability. Available water capacity is high. Depth to the water table is more than 6 feet. These soils are subject to flooding.

A representative profile of Norwood silt loam, 880 feet north and 1,380 feet west of the southeast corner of sec. 13, T. 9 S., R. 10 E.:

Ap—0 to 9 inches; dark reddish brown (5YR 3/5) silt loam, reddish brown (5YR 5/3) dry; weak fine granular; structure; hard, firm; few fine roots; some organic stains; few worm castings; calcareous; moderately alkaline; gradual smooth boundary.

A12—9 to 27 inches; dark reddish brown (5YR 3/4) silty clay loam, reddish brown (5YR 5/4) dry; weak fine and medium granular structure and subangular blocky; hard, firm; few fine strata of fine sandy loam and silt loam; few fine roots; few worm castings; mycellium in root channels; calcareous; moderately alkaline; abrupt smooth boundary.

C1—27 to 38 inches; dark reddish brown (2.5YR 3/4) silty clay loam, reddish brown (2.5YR 5/4) dry; weak fine medium subangular blocky structure; hard, firm; few fine roots; common worm castings; evident bedding planes of finer textured or coarser textured strata; mycellium in root channels; calcareous; moderately alkaline; abrupt smooth boundary.

C2—38 to 60 inches; dark reddish brown (2.5YR 3/4) silty clay loam, reddish brown (2.5YR 4/4) dry; moderate fine and medium subangular blocky structure; hard, firm; few very fine roots; pressure faces on some peds; small shells; some mycellium in root channels; evident bedding planes and stratification; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. The soil is calcareous and moderately alkaline throughout. Bedding planes are evident throughout. The A1 or Ap horizon is reddish brown, dark reddish brown, or dark brown. The dark reddish brown and dark brown horizons are less than 10 inches thick. The C horizon is reddish brown, reddish yellow, yellowish red, or dark reddish brown. It is silt loam, loam, or silty clay loam.

61—Norwood silt loam. This soil is nearly level and is subject to rare flooding. Included with this soil in mapping are about 10 percent areas of Severn soils and 5 percent areas of Redport soils.

This soil is suited to all crops commonly grown in the area. The main crops are alfalfa hay, grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture (fig. 5). A few small areas are managed for woodland.

The main concerns in management are controlling flooding and maintaining tilth and fertility. Most crops that produce a large amount of residue can be grown continuously where the soil is well managed and where most of the crop residue is returned to the soil. Additions of plant food help to maintain organic matter content, tilth, and fertility. Diversion terraces can be used to control runoff from higher positions on the landscape. Minimum tillage needs to be used. Capability unit I-1; not assigned to range site; woodland group 2o.

Okay Series

The Okay series consists of nearly level to very gently sloping soils on uplands. These soils formed in material weathered from loamy sediment under a cover of native grasses and scattered trees.

In a representative profile the surface layer is 11 inches of dark brown fine sandy loam underlain by 6 inches of dark reddish brown loam. The upper part of the subsoil is reddish brown clay loam 6 inches thick, the middle part is yellowish red clay loam 32 inches thick, and the lower part is brown fine sandy loam 13 inches thick.

Okay soils are well drained and have moderate permeability. The available water capacity is high. The depth to the water table is more than 6 feet.

Representative profile of Okay fine sandy loam, 0 to 1 percent slopes, 2,000 feet south and 320 feet west of the northeast corner of sec. 15, T. 8 S., R. 11 E.:

Ap—0 to 11 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak fine granular structure; slightly hard, friable; slightly acid; gradual smooth boundary.

A1—11 to 17 inches; dark reddish brown (5YR 3/3) loam, reddish brown (5YR 5/3) dry; moderate fine and medium granular structure; hard, friable; many fine pores; some worm castings; some organic stains; slightly acid; gradual smooth boundary.

B1—17 to 23 inches; reddish brown (5YR 4/4) clay loam, light reddish brown (5YR 6/4) dry; moderate fine and medium granular and subangular blocky structure; many small pores; few manganese concretions; organic stains in some pores; slightly acid; gradual smooth boundary.

B21t—23 to 41 inches; yellowish red (5YR 4/6) clay loam, reddish yellow (5YR 6/6) dry; weak medium subangular blocky structure; hard, firm; many fine pores; common organic stains in pores; clay films on faces of peds; few very small manganese concretions; slightly acid; gradual smooth boundary.

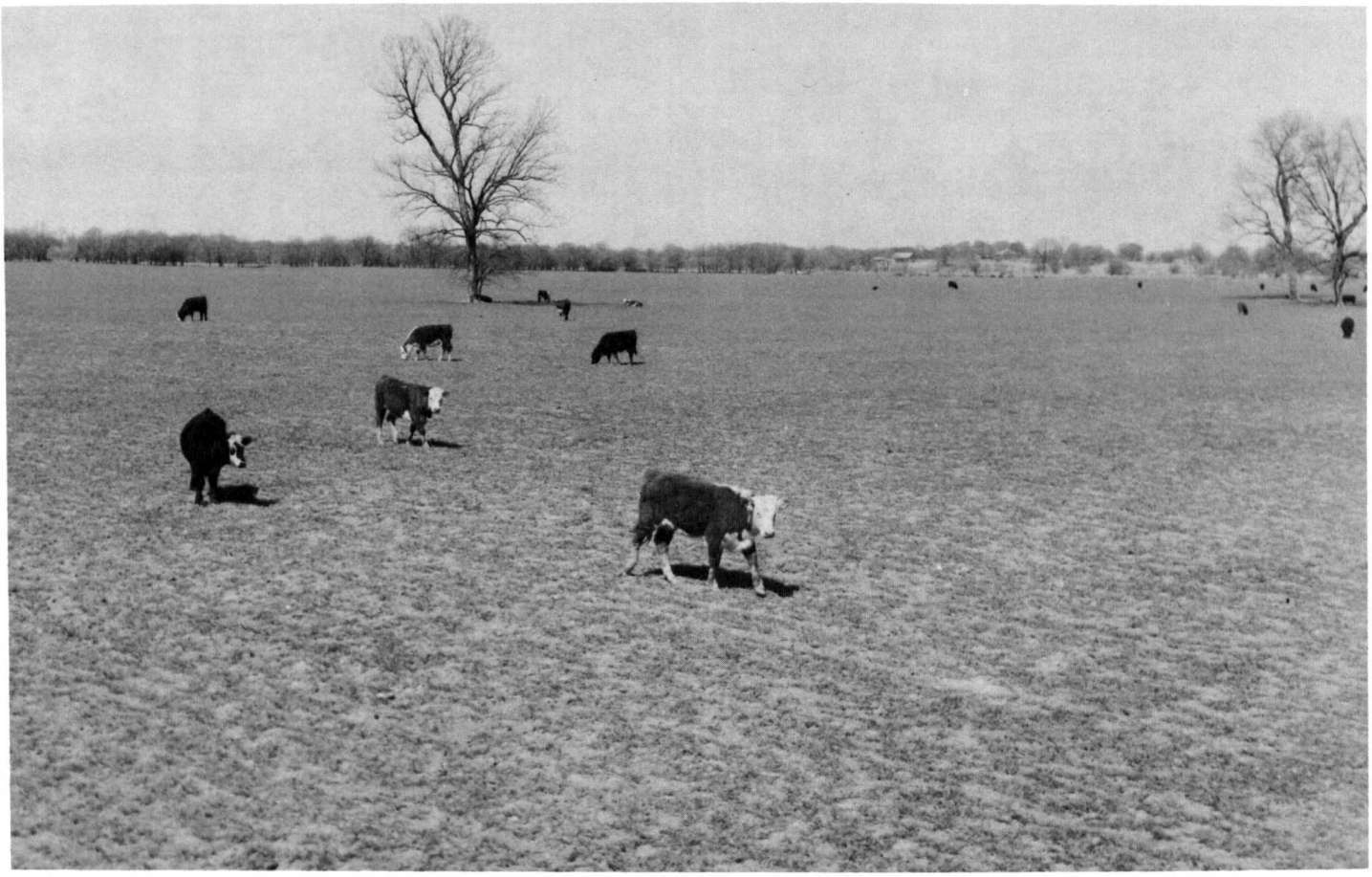

Figure 5.—**Wheat pasture for beef cattle on Norwood silt loam.**

B22t—41 to 55 inches; yellowish red (5YR 5/6) clay loam, reddish yellow (5YR 6/6) dry; weak medium subangular blocky structure; hard, firm; some organic stains in pores; clay films on faces of peds; medium acid; clear smooth boundary.

B3—55 to 68 inches; brown (7.5YR 5/4) fine sandy loam, pink (7.5YR 7/4) dry; weak medium prismatic structure; slightly hard, friable; clay films bridging sand grains; streaks of clean sand grains; medium acid.

The depth to bedrock is more than 60 inches. The A1 or Ap horizon is very dark grayish brown, dark brown, or dark reddish brown. It is loam or fine sandy loam and ranges from medium acid to slightly acid. The B1 horizon is dark reddish brown, dark reddish gray, reddish brown, brown, or dark brown. It is loam, clay loam, or sandy clay loam and ranges from medium acid to slightly acid. The B2t horizon is yellowish red, reddish brown, dark reddish brown, dark red, brown, or dark brown. It is clay loam or sandy clay loam and ranges from medium acid to slightly acid. The B3 horizon ranges from yellowish red to dark brown. It is fine sandy loam or sandy clay loam and ranges from medium acid to neutral.

62—Okay fine sandy loam, 0 to 1 percent slopes. This soil is nearly level. It has a profile described as representative of the series. Included with this soil in mapping are 10 percent areas of Karma soils and about 5 percent areas of Okay soils.

This soil is used mostly for soybeans, wheat, grain sorghum, peanuts, cotton, and alfalfa hay (fig. 6). Tame pasture is grown in some areas. This soil is also suited to native grasses.

The main concerns in management are controlling erosion on long slopes and maintaining tilth and fertility. This soil can be used continuously for clean-tilled crops where plant food is added and where the crop residue is returned to the soil. Proper management of crop residue helps maintain tilth and improves water intake. In a few areas, diversion terraces on long slopes are used to prevent excessive sheet erosion. Capability unit I-2; Loamy Prairie range site; not assigned to woodland group.

63—Okay loam, 0 to 1 percent slopes. This soil is nearly level. It has a profile similar to the one described as representative of the series, but the surface layer is a loam. Included in mapping are about 20 percent areas of a soil similar to this Okay soil, but the subsoil is more than 60 inches thick and is yellowish brown or dark yellowish brown.

This soil is used mostly for soybeans, wheat, grain sorghum, peanuts, cotton, and alfalfa hay. Tame pasture is grown in some areas. This soil is also suited to native grasses.

The main concerns in management are controlling erosion on long slopes and maintaining tilth and fertility. This soil can be continuously used for clean-

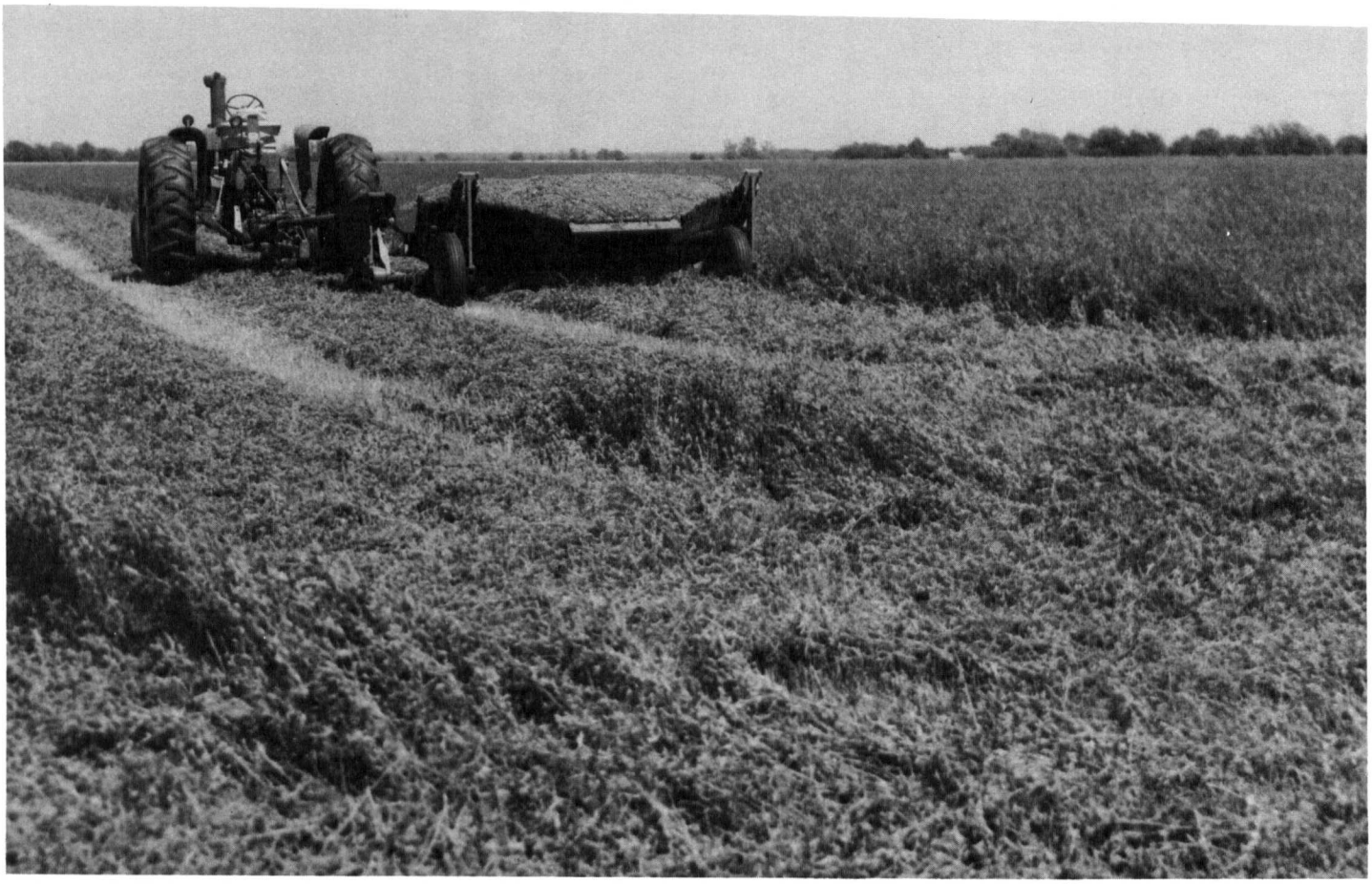

Figure 6.—Alfalfa being cut on Okay fine sandy loam, 0 to 1 percent slopes.

tilled crops where plant food is added and where the crop residue is returned to the soil. Proper management of crop residue helps maintain tilth and improves water intake. In a few areas, diversion terraces on long slopes are used to prevent excessive sheet erosion. Capability unit I-2; Loamy Prairie range site; not assigned to woodland group.

64—Okay loam, 1 to 3 percent slopes. This soil is very gently sloping. It has a profile similar to the one described as representative of the series, but the surface layer is loam. Included with this soil in mapping are about 5 percent areas of a soil that is similar to this Okay soil, but the subsoil is more than 60 inches thick and is yellowish brown or dark yellowish brown. Also included are a few small areas of eroded soils.

This soil is used mostly for grain sorghum, soybeans, wheat, peanuts, and cotton. Tame pasture is grown in some areas. This soil is also suited to native grasses.

The main concerns in management are controlling erosion and maintaining tilth and fertility. The cropping system needs to return an adequate amount of residue to the soil. Erosion can be reduced by using contour farming with terraces and by managing crop residue. Plant cover is needed during winter and spring to help prevent erosion. Using plant food increases plant growth and provides additional crop residue for erosion control. Terracing, contour farming, and using cover crops are especially needed where row crops are grown. Capability unit IIe-1; Loamy Prairie range site; not assigned to woodland group.

Oklared Series

The Oklared series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy and sandy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is dark reddish brown fine sandy loam 7 inches thick. The underlying material is reddish brown loam 5 inches thick over yellowish red very fine sandy loam to a depth of 60 inches.

Oklared soils are well drained and have moderately rapid permeability. The available water capacity is medium. The depth to the water table is 3 to 4 feet. These soils are subject to flooding.

Representative profile of Oklared fine sandy loam 480 feet east and 1,280 feet north of the southwest corner of sec. 14, T. 8 S., R. 11 E.:

A1—0 to 7 inches; dark reddish brown (5YR 3/3) fine

sandy loam, reddish brown (5YR 5/3) dry; moderate medium and fine granular structure; hard, friable; few worm castings; calcareous; moderately alkaline; clear smooth boundary.

C1—7 to 12 inches; reddish brown (5YR 4/4) loam, light reddish brown (5YR 6/4) dry; weak fine granular structure; hard, friable; few worm castings; calcareous; moderately alkaline; clear smooth boundary.

C2—12 to 24 inches; yellowish red (5YR 5/6) very fine sandy loam, reddish yellow (5YR 7/6) dry; weak fine granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C3—24 to 33 inches; yellowish red (5YR 5/6) very fine sandy loam, reddish yellow (5YR 7/6) dry; weak fine granular structure; soft, very friable; calcareous; moderately alkaline; clear smooth boundary.

C4—33 to 60 inches; yellowish red (5YR 5/6) very fine sandy loam, reddish yellow (5YR 7/6) dry; weak fine granular structure; slightly hard, very friable; few thin seams of lime; stratified with light loam and loamy very fine sand at a depth of more than 48 inches; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. The A1 or Ap horizon is dark reddish brown, reddish brown, brown, strong brown, or dark brown. It is a fine sandy loam or silty clay loam. The C horizon is reddish brown, yellowish red, light reddish brown, light red, reddish yellow, or red. It is very fine sandy loam, loam, or fine sandy loam at a depth of 10 to 40 inches. The C horizon has a thin layer of loamy fine sand at a depth of more than 40 inches.

65—Oklared fine sandy loam. This soil is nearly level and is subject to rare flooding. It has a profile described as representative of the series. Included with this soil in mapping are about 10 percent areas of Norwood soils; 5 percent areas of Redport soils; and 20 percent areas of a soil similar to the soil described as representative of the series, but the surface layer is darker and thicker.

This soil is suited to all crops commonly grown in the area. The main crops are alfalfa hay, grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture. A few small areas are managed for woodland.

The main concerns in management are controlling flooding and maintaining tilth and fertility. Most crops that produce a large amount of residue can be grown continuously where the soil is well managed and where most of the crop residue is returned to the soil. Additions of plant food help to maintain organic matter content, tilth, and fertility. Diversion terraces can be used to control runoff from higher positions on the landscape. Minimum tillage needs to be used. Capability unit I-1; not assigned to range site; woodland group 2o.

66—Oklared silty clay loam. This soil is nearly level and is subject to rare flooding. It has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. Included with this soil in mapping are about 5 percent areas of Norwood soils and 20 percent areas of a soil similar to this Oklared soil, but the surface layer is darker and thicker.

This soil is suited to all crops commonly grown in the area (fig. 7). The main crops are alfalfa hay, grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture. A few small areas are managed for woodland.

The main concerns in management are controlling flooding and maintaining tilth and fertility. Most crops that produce a large amount of residue can be grown continuously where the soil is well managed and most of the crop residue is returned to the soil. Additions of plant food help to maintain organic matter content, tilth, and fertility. Diversion terraces can be used to control runoff from higher positions on the landscape. Minimum tillage needs to be used. Capability unit I-1; not assigned to range site; woodland group 2o.

Parson Series

The Parsons series consists of nearly level soils on uplands. They formed in material weathered from loamy or clayey sediment under a cover of native grass.

In a representative profile the surface layer is very dark grayish brown silt loam 11 inches thick. The subsurface layer is gray silt loam 3 inches thick. The upper 22 inches of the subsoil is very dark gray clay, the middle 13 inches is dark gray clay, and the lower part is coarsely mottled light brownish gray, light gray, and brownish yellow silty clay.

Parsons soils are somewhat poorly drained and have very slow permeability. Available water capacity is medium. The water table ranges in depth from 0.5 foot to 1.5 feet for brief periods during December through April.

Representative profile of Parsons silt loam, 0 to 1 percent slopes, 1,820 feet north and 460 feet east of the southwest corner of sec. 25, T. 7 S., R. 7 E.:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

A2—11 to 14 inches; gray (10YR 5/1) silt loam, light gray (10YR 6/1) dry; common medium prominent reddish brown (5YR 4/4) mottles dry; weak fine granular structure; slightly hard, friable; medium acid; abrupt wavy boundary.

B21tg—14 to 18 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; common fine red mottles; moderate fine and medium blocky structure; very hard, very firm; thin clay films; coatings from A2 horizon as much as 2 millimeters thick on faces of peds; strongly acid; gradual smooth boundary.

B22tg—18 to 36 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium blocky structure; very hard, very firm; thin clay films; few fine iron and manganese concretions; slightly acid; gradual smooth boundary.

B23t—36 to 49 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common medium and coarse light yellowish brown (10YR 6/4) mottles; dry; moderate medium blocky structure; very hard, very firm; thin clay films, few fine pebbles, few fine iron and manganese concretions; slightly acid; gradual smooth boundary.

B3—49 to 62 inches; coarsely mottled light brownish gray 2.5Y 6/2), light gray (10YR 7/1), and brownish yellow (10YR 6/6) silty clay; weak coarse subangular blocky structure; very hard, very firm; organic stains; thin patchy clay films; few fine iron and manganese concretions; mildly alkaline.

The depth to bedrock is more than 60 inches. The A horizon is less than 16 inches thick. The A1 or Ap horizon is generally dark grayish brown or very dark grayish brown, but where the A horizon is less than 10 inches thick or is less than 1 percent organic matter, it is very dark grayish brown. The A2 horizon is gray, dark gray,

Figure 7.—Pecan trees on Oklared silty clay loam.

dark grayish brown, or grayish brown. Reddish, brownish, and yellowish mottles are in some profiles. The A horizon ranges from strongly acid to slightly acid, and it is neutral where limed. The B2t horizon is dark gray, very dark gray, gray, grayish brown, very dark grayish brown, or dark grayish brown. It has brownish, reddish, or grayish mottles. It is clay, silty clay, clay loam, or silty clay loam and ranges from strongly acid to slightly acid in the lower part. The B3 horizon ranges from dark gray to dark grayish brown and from clay to silty clay loam. It is neutral to mildly alkaline.

67—Parsons silt loam, 0 to 1 percent slopes. This soil is nearly level. Included with this soil in mapping are less than 5 percent areas of Woodson soils and less than 12 percent areas of a soil similar to this Parsons soil, but the combined thickness of the surface layer and subsurface layer is 16 to 36 inches.

This soil is used mainly for wheat, soybeans, grain sorghum, peanuts, cotton, and tame pasture. A few small areas are managed for native grasses.

The main concerns in management are maintaining tilth; increasing intake of water; and controlling surface crusting, seasonal wetness or droughtiness, and erosion on long slopes. This soil can be used continuously for clean-tilled crops where adequate plant food is added and where crop residue is returned to the surface. A large amount of crop residue maintains organic matter content and tilth, increases water intake, and prevents surface crusting. Winter cover crops furnish protection against erosion. In a few areas, diversion terraces on long slopes can be used to reduce erosion. A drainage system coupled with arranging rows for drainage reduces surface wetness and improves crop production. Tillage should be timely and kept to a minimum. Capability unit IIs-1; Claypan Prairie range site; not assigned to woodland group.

Pits

68—Pits. This mapping unit is mostly in areas of Karma, Larton, Okay, Dennis, and Durant soils from which soil material has been excavated for building roads, dams, foundations, and other similar structures. The pits are 5 to 30 feet deep, 300 to 5,000 feet long and 150 to 600 feet wide. They have nearly vertical sides and very gently sloping to sloping bottoms. The soil material consists of various combinations of sand, loamy fine sand, loam, sandy clay loam, clay loam, and clay. Reaction is mostly medium acid to mildly alkaline. Included with these areas in mapping are minor areas of limestone quarries.

Areas of this mapping unit are suited to native

grasses, to improved bermudagrass, and to use as wildlife habitat.

The main concerns in management are leveling steep slopes, controlling erosion, and maintaining tilth and fertility. Management is needed to establish or to improve and maintain stands of plant cover. Land leveling, establishing desirable plant cover, controlled grazing, and adding plant food are needed in places. Capability unit VIIs-2; not assigned to range site or woodland group.

Pledger Series

The Pledger series consists of nearly level soils on flood plains. These soils formed in material weathered from clayey and loamy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is dark brown clay 28 inches thick. The upper part of the subsoil is reddish brown clay 18 inches thick; the lower part is dark reddish brown clay 30 inches thick.

Pledger soils are somewhat poorly drained and have very slow permeability. Available water capacity is medium. Depth to the water table ranges from 0 to 2.5 feet during December through February. Pledger soils are subject to flooding.

Representative profile of Pledger clay, 1,520 feet south and 330 feet west of the northeast corner of sec. 3, T. 8 S., R. 12 E.:

Ap—0 to 8 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; moderate fine granular structure; very hard, firm; some worm castings; organic stains in root channels; noncalcareous; moderately alkaline; clear smooth boundary.

A1—8 to 28 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; few fine faint reddish brown mottles; moderate fine granular and subangular blocky structure; very hard, firm; few small carbonate concretions; calcareous in seams; moderately alkaline; clear smooth boundary.

B21—28 to 46 inches; reddish brown (2.5YR 4/4) clay, reddish brown (2.5YR 5/4) dry; moderate fine blocky structure; very hard, firm; some cracks filled with material from A horizon; common carbonate concretions as much as ¼ inch in diameter; calcareous; moderately alkaline; clear smooth boundary.

B22—46 to 76 inches; dark reddish brown (2.5YR 3/4) clay, reddish brown (2.5YR 4/4) dry; few fine faint red mottles; moderate fine blocky structure; very hard, firm; organic stains in root channels; common fine carbonate concretions; slightly hard iron and manganese material; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. Thickness of the A horizon ranges from 20 to 40 inches. Wide cracks are common during dry periods. The A1 or Ap horizon is dark brown, very dark brown, or very dark grayish brown. It ranges from slightly acid to moderately alkaline. The solum is typically calcareous at a depth of more than 12 inches. The B2 horizon is dark reddish brown, reddish brown, or dark brown. In some profiles, there is a dark reddish brown, reddish brown, or dark brown clay C horizon that has thin strata of very fine sandy loam to silty clay loam.

69—Pledger clay. This soil is nearly level and is subject to rare flooding. Included with this soil in mapping are less than 5 percent areas of Ships soils and about 30 percent areas of a soil similar to this Pledger soil, but the subsoil is yellowish red. Also included and making up 5 percent of the mapped area are areas of a soil similar to this Pledger soil, but the surface layer is silt loam or silty clay loam.

This soil is used mostly for tame pasture, grain sorghum, wheat, soybeans, and cotton. Some areas are managed for woodland.

The main concerns in management in cultivated areas are controlling flooding and surface wetness, increasing water intake, and maintaining tilth. Close-grown crops are needed to prevent excessive erosion during flooding. Planting in spring needs to be delayed until after the period of common flooding. Most crops can be grown continuously where plant food is added that provides for maximum crop residue. A large amount of residue helps maintain organic matter content and improves tilth and intake of water. Where this soil is wet, tilling or grazing breaks down tilth and reduces water intake. A drainage system coupled with arranging rows for drainage reduces surface wetness and improves quality and quantity of crops. Capability unit IIs-2; not assigned to range site; woodland group 3w.

Redport Series

The Redport series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is dark reddish brown silty clay loam 31 inches thick. The upper part of the subsoil is reddish brown silty clay loam 13 inches thick; the lower part is yellowish red silty clay loam 30 inches thick.

Redport soils are well drained and have moderate permeability. Available water capacity is high. The water table is at a depth of more than 6 feet. Redport soils are subject to flooding.

Representative profile of Redport silty clay loam, 2,580 feet west and 540 feet south of the northeast corner of sec. 13, T. 9 S., R. 10 E.:

Ap—0 to 9 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/3) dry; moderate fine granular structure; hard, friable; calcareous; moderately alkaline; clear smooth boundary.

A11—9 to 17 inches; dark reddish brown (5YR 3/2) silty clay loam, dark reddish gray (5YR 4/2) dry; moderate fine subangular blocky structure; very hard, firm; material from Ap horizon in small cracks; calcareous; moderately alkaline; gradual smooth boundary.

A12—17 to 31 inches; dark reddish brown (5YR 3/2) silty clay loam, dark reddish gray (5YR 4/2) dry; moderate fine granular structure; hard, firm; calcareous; moderately alkaline; gradual smooth boundary.

B2—31 to 44 inches; reddish brown (5YR 4/4) silty clay loam, reddish brown (5YR 5/4) dry; weak fine subangular blocky structure; very hard, firm; few dark stains on faces of peds; common threads of calcium carbonate, calcareous; moderately alkaline; gradual smooth boundary.

B3—44 to 74 inches; yellowish red (5YR 4/6) silty clay, yellowish red (5YR 5/6) dry; weak fine subangular blocky structure; very hard, firm; few stains on faces of peds; calcareous; moderately alkaline.

Depth to bedrock is more than 60 inches. All horizons at a depth of more than 10 inches range from mildly alkaline to moderately alkaline and calcareous. The A1 or Ap horizon is dark reddish brown or dusky red. It is 24 to 40 inches thick. The B2 and B3 horizons are reddish brown, yellowish red, dark reddish brown, dark red, or red. They are silt loam, clay loam, or silty clay loam. The C horizon, where present, is at a depth of more than 40 inches. It ranges from reddish brown to red and contains thin strata ranging from fine sandy loam to silty clay loam. In some profiles a buried A horizon is at a depth of more than 30 inches.

70—Redport silty clay loam. This soil is nearly level and is subject to rare flooding. Included with this soil in mapping are about 5 percent areas of Norwood soils and 10 percent areas of Ships soils.

This soil is suited to all crops commonly grown in the area. The main crops are alfalfa hay, grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture (fig. 8). A few small areas are managed for woodland.

The main concerns in management are controlling flooding and maintaining tilth and fertility. Most crops that produce a large amount of residue can be grown continuously where the soil is well managed and where most of the crop residue is returned to the soil. Additions of plant food help to maintain organic matter content, tilth, and fertility. Diversion terraces can be used to control runoff from higher positions on the landscape. Minimum tillage needs to be used. Capability unit I-1; not assigned to range site; woodland group 2o.

Romia Series

The Romia series consists of gently sloping to moderately steep soils on uplands. These soils formed in sandy and loamy sediment in material weathered from sandstone under a cover of trees and an understory of grasses.

In a representative profile the surface layer is dark brown cobbly loamy fine sand 6 inches thick. The subsurface layer is reddish brown gravelly fine sand 12 inches thick, and the lower part is red sandy clay loam 13 inches thick. The underlying material is rippable soft sandstone.

Romia soils are well drained and have moderate permeability. Available water capacity is medium. The water table is at a depth of more than 6 feet.

Representative profile of Romia cobbly loamy fine sand, in an area of Bernow-Romia complex, 8 to 20 percent slopes, 1,650 feet west and 2,600 feet north of the southeast corner of sec. 13, T. 6 S., R. 7 E.:

Figure 8.—Alfalfa on Redport silty dry loam.

A1—0 to 6 inches; dark brown (7.5YR 3/2) cobbly loamy fine sand, brown (7.5YR 5/2) dry; weak very fine granular structure; soft, very friable; 20 percent cobblestones, by volume; medium acid; clear smooth boundary.

A2—6 to 18 inches; reddish brown (5YR 5/4) gravelly fine sand, light reddish brown (5YR 6/4) dry; single grained; loose dry or moist; 20 percent cobblestones and 30 percent pebbles; strongly acid; clear wavy boundary.

B21t—18 to 34 inches; yellowish red (5YR 5/6) sandy clay loam, light reddish brown (5YR 6/4) dry; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few clean sand grains; clay films bridging sand grains; very strongly acid; gradual smooth boundary.

B22t—34 to 47 inches; red (2.5YR 4/8) sandy clay loam, red (2.5YR 5/8) dry; common medium prominent reddish yellow (7.5YR 6/8) mottles; weak coarse prismatic structure and moderate medium subangular blocky; hard, firm; clay films on faces of peds; very strongly acid; clear wavy boundary.

C—47 to 56 inches; soft sandstone.

Solum thickness and depth to sandstone range from 40 to 60 inches. The A1 or Ap horizon is very dark grayish brown, dark grayish brown, grayish brown, brown, or dark brown. The A2 horizon is reddish brown, light brown, light yellowish brown, yellowish brown, brown, or pale brown. The A2 horizon is reddish brown, light brown, light yellowish brown, yellowish brown, brown, or pale brown. The A horizon is gravelly fine sand, cobbly fine sand, gravelly loamy fine sand, or cobbly loamy fine sand, and it is 2 to 30 percent cobblestones and gravel. It ranges from slightly acid to strongly acid. The B2t horizon is reddish brown, yellowish red, or red. Grayish mottles occur at a depth of more than 30 inches in some pedons. The B2t horizon is sandy clay loam, clay loam, gravelly sandy clay loam, or gravelly clay loam, and it is 0 to 35 percent pebbles. It ranges from medium acid to very strongly acid. The underlying sandstone is laminated with bands of ironstone in some profiles.

Romia soils are mapped in complexes with Bernow and Ferris soils.

San Saba Series

The San Saba series consists of very gently sloping to sloping soils on uplands. These soils formed in clayey material weathered from limestone under a cover of native grasses.

In a representative profile the surface layer is black clay 14 inches thick. The next layer is olive clay 12 inches thick. It is underlain by grayish, partly fractured limestone that is not rippable.

San Saba soils are moderately well drained and have very slow permeability. Available water capacity is medium. Depth to the water table is more than 6 feet.

Representative profile of the San Saba clay, in an area of San Saba-Tarrant complex, 1 to 8 percent slopes, 2,100 feet south and 300 feet west of the northeast corner of sec. 25, T. 5 S., R. 8 E.:

A1—0 to 14 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate, fine granular structure; very hard, firm; few fine calcium carbonate concretions; few worm castings; few sea shells; calcareous; moderately alkaline; gradual smooth boundary.

AC—14 to 26 inches; olive (5Y 4/3) clay, olive (5Y 5/3) dry; moderate fine and medium blocky structure; very hard, very firm; common and medium blocky structure; very hard, very firm; common shiny pressure face; calcium carbonate concretions; few small shells; few intersecting slickensides; material from A1 horizon in wide cracks; calcareous; moderately alkaline; abrupt smooth boundary.

R—26 to 30 inches; grayish, partly fractured limestone.

The depth to bedrock ranges from 24 to 40 inches. Wide cracks occur where the soil is dry. Reaction ranges from mildly alkaline to moderately alkaline. The solum is generally calcareous but is noncalcareous in places to a depth of 15 inches. The A1 or Ap horizon is black, very dark gray, or dark gray. The AC horizon is gray, dark gray, dark grayish brown, grayish brown, olive gray, or olive. In some profiles it has grayish mottles.

71—San Saba-Tarrant complex, 1 to 8 percent slopes. This complex consists of very gently sloping to sloping soils. About 60 percent of this complex is San Saba clay, and 40 percent is Tarrant soils. These soils are in such an intricate pattern that it is impractical to map them separately. The San Saba soil is on side slopes, and the Tarrant soil is on crests. The San Saba soil in an area of this complex has the profile described as representative of the San Saba series. The Tarrant soil has a profile similar to the one described as representative of the Tarrant series, but the surface layer is about 7 inches thick and the depth to limestone is 14 inches.

These soils are used mainly for native grass. A few areas are in tame pasture.

The main concerns in management are depth to limestone, slow water intake, tilth, and rock outcrop in a few areas. The use of farm machinery is limited in the areas of rock outcrop. Preventing overgrazing of native grasses and tame pasture improves water intake, reduces erosion, and maintains tilth. The quality of grasses can be maintained or improved by preventing overgrazing, controlling weeds, and protecting the areas from fire. Adding plant food and preventing overgrazing improve the quality and quantity of tame pasture and protect the soil from erosion. Capability unit VIe-1; San Saba part in Blackclay Prairie range site, and Tarrant part in Very Shallow range site; not assigned to woodland group.

Severn Series

The Severn series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy and sandy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is reddish brown fine sandy loam 10 inches thick. In sequence downward, the underlying material is 5 inches of reddish brown loamy fine sand, 15 inches of yellowish red very fine sandy loam, 26 inches of dark reddish brown silt loam, and 18 inches of dark reddish brown loam.

Severn soils are well drained and have moderately rapid permeability. Available water capacity is high. Depth to the water table is more than 6 feet. Severn soils are subject to flooding.

Representative profile of Severn fine sandy loam, 1,260 feet west and 920 feet north of the southeast corner of sec. 14, T. 9 S., R. 10 E.:

Ap—0 to 10 inches; reddish brown (5YR 4/4) fine sandy loam, light reddish brown (5YR 6/4) dry; weak fine

granular structure; slightly hard, very friable; many fine pores; calcareous; moderately alkaline; clear smooth boundary.

C1—10 to 15 inches; reddish brown (5YR 4/4) loamy very fine sand, light reddish brown (5YR 6/4) dry; weak fine granular structure; slightly hard, very friable; many pores; calcareous; moderately alkaline; clear smooth boundary.

C2—15 to 30 inches; yellowish red (5YR 4/6) very fine sandy loam, yellowish red (5YR 5/6) dry; weak fine subangular blocky and granular structure; slightly hard, very friable; many fine pores; calcareous; moderately alkaline; clear smooth boundary.

C3—30 to 41 inches; dark reddish brown (2.5YR 3/4) silt loam, reddish brown (2.5YR 4/4) dry; weak fine subangular blocky structure; very hard, firm; many fine pores; few fine threads of lime; some worm castings; calcareous; moderately alkaline; clear smooth boundary.

C4—41 to 56 inches; dark reddish brown (2.5YR 3/4) silt loam, reddish brown (2.5YR 4/4) dry; weak fine granular and subangular blocky structure; slightly hard, friable; many fine pores; common fine threads of lime; few castings; common bedding planes; calcareous; moderately alkaline; clear smooth boundary.

C5—56 to 74 inches; dark reddish brown (2.5YR 3/4) loam, reddish brown (2.5YR 4/4) dry; weak fine granular structure; slightly hard, friable; many fine pores; few fine threads of lime; some worm castings; common bedding planes; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. The A1 or Ap horizon is dark reddish brown or reddish brown. The C horizon is reddish yellow, reddish brown, dark reddish brown, or yellowish red. It ranges from very fine sandy loam to loamy very fine sand and has thin strata of silt loam, loam, and fine sandy loam. Within a depth of 40 inches, combined thickness of the loam and silt loam layers that have more than 18 percent clay is less than 8 inches.

72—Severn fine sandy loam. This soil is nearly level and is subject to rare flooding. Included with this soil in mapping are about 5 percent areas of Norwood soils, 5 percent areas of Redport soils, and 10 percent areas of Oklared soils.

This soil is suited to all crops commonly grown in the area. The main crops are alfalfa hay, grain sorghum, soybeans, wheat, peanuts, cotton, and tame pasture. A few small areas are managed for woodland.

The main concerns in management are controlling flooding and maintaining tilth and fertility. Most crops that produce a large amount of residue can be grown continuously where the soil is well managed and where most of the crop residue is returned to the soil. Additions of plant food help to maintain organic matter content, tilth, and fertility. Diversion terraces can be used to control runoff from positions higher on the landscape. Minimum tillage is needed. Capability unit I-1; not assigned to range site; woodland group 2o.

Ships Series

The Ships series consists of nearly level soils on flood plains. These soils formed in material weathered from clayey sediment under a cover of native grasses and scattered trees.

In a representative profile the surface layer is dark reddish brown clay 15 inches thick. The upper part of the subsoil is dark red clay 27 inches thick, and the lower part is red clay 31 inches thick.

Ships soils are moderately well drained and have very slow permeability. Available water capacity is medium. Depth to the water table is more than 6 feet. Ships soils are subject to flooding.

Representative profile of Ships clay, 1,250 feet south and 50 feet west of the northeast corner of sec. 20, T. 8 S., R. 11 E.:

Ap—0 to 15 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; moderate medium granular structure; hard, very firm; few worm castings; calcareous; moderately alkaline; clear smooth boundary.

B21—15 to 31 inches; dark red (2.5YR 3/6) clay, red (2.5YR 5/6) dry; moderate fine blocky structure; very hard, very firm; few worm castings; few cracks filled with material from Ap horizon; calcareous; moderately alkaline; clear smooth boundary.

B22—31 to 42 inches; dark red (2.5YR 3/6) clay, red (2.5YR 5/6) dry; moderate fine blocky structure; very hard, very firm; few cracks filled with material from Ap and B21 horizons; few fine carbonate concretions; calcareous; moderately alkaline; clear smooth boundary.

B23—42 to 73 inches; red (2.5YR 4/6) clay, red (2.5YR 5/6) dry; weak fine and medium blocky structure; very hard, very firm; few fine carbonate concretions; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. Cracks are prevalent during dry periods. Small slickensides are in some pedons, but they do not intersect. The B2 horizon is dark reddish brown, reddish brown, dark red, or red. Carbonate concretions are in most profiles, and threads of lime are in some. In some profiles an Ab horizon is at a depth of more than 24 inches. In some profiles a C horizon is at a depth of more than 40 inches. It is dark reddish brown to red and has strata of very fine sandy loam to silty clay loam.

73—Ships clay. This soil is nearly level and is subject to rare flooding. It has a profile described as representative of the series. Included with this soil in mapping are less than 5 percent areas of Pledger soils, less than 5 percent areas of Redport soils, and less than 3 percent areas of soils similar to this Ships soil, but they are ponded. Also included are about 5 percent soils that are similar to this Ships soil but that have a loamy subsoil at a depth of more than 24 inches.

This soil is used for alfalfa hay, wheat, soybeans, grain sorghum, cotton, and tame pasture. Some areas of this soil are in woodland.

The main concerns in management are controlling flooding and surface wetness, increasing intake of water, and maintaining tilth. Most crops can be grown continuously where plant food is added that provides for maximum crop residue. A large amount of residue helps maintain organic matter content and improves tilth and intake of water. Where this soil is wet, tillage or grazing breaks down tilth and reduces water intake. In wet areas, a drainage system coupled with arranging rows for drainage reduces surface wetness and improves quality and yield of crops. Capability unit IIs-3; not assigned to range site; woodland group 3w.

74—Ships clay, depressional. This nearly level soil is in depressional areas and is subject to frequent flooding. It has a profile similar to the one described as representative of the series, but the surface layer is about 14 inches thick. Included with this soil in mapping are 3 percent areas of Pledger soils and 2 percent

areas of Redport soils. Also included are 10 percent areas of soils that have a profile similar to the one described as representative of the Ships series but that have a surface layer of very fine sandy loam, silt loam, and silty clay loam or that have a loamy subsoil at a depth of more than 24 inches.

This soil is used mainly for tame pasture and woodland. A few small areas are used for wildlife.

The main concerns in management are controlling surface wetness, ponding, and flooding and maintaining tilth and water intake. Wet areas and ponded areas can be established to water-tolerant grasses. Simple drainage systems, where needed and practical, help to establish and improve the production of tame pasture. Growth of tame pasture can be increased by adding plant food and preventing overgrazing. A good grass mulch helps to maintain tilth and improves intake of water. In woodland areas, thinning, weeding, selective cutting, and protecting the areas from fire will improve the quality of trees. Capability unit Vw-1; not assigned to range site; woodland group 3w.

Tarrant Series

The Tarrant series consists of very gently sloping to moderately steep soils on uplands. These soils formed in clayey material weathered from limestone under a cover of native grasses.

In a representative profile the surface layer is 6 inches of very dark brown cobbly silty clay underlain by 10 inches of very dark brown cobbly clay. Below this is grayish limestone bedrock that is not rippable.

Tarrant soils are well drained and have moderately slow permeability. Available water capacity is low. Depth to the water table is more than 6 feet.

Representative profile of Tarrant soils, 1 to 8 percent slopes, 2,470 feet west and 20 feet north of the southeast corner of sec. 19, T. 5 S., R. 8 E.:

A1—0 to 6 inches; very dark brown (10YR 2/2) cobbly silty clay, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure; very hard, very firm; 10 percent cobbles, 2 percent stones, and 5 percent gravel limestone, by volume; calcareous; moderately alkaline; gradual smooth boundary.

A12ca—6 to 16 inches; very dark (10YR 2/2) cobbly clay, very dark grayish brown (10YR 3/2) dry; strong fine subangular blocky structure; very hard, very firm; few small seashells; 50 percent gravel and cobbles and about 5 percent stones, by volume; calcium carbonate coatings of limestone; calcareous; moderately alkaline; abrupt wavy boundary.

R—16 to 20 inches; grayish limestone bedrock.

Solum thickness and depth to limestone range from 6 to 20 inches. The A1 or Ap horizon is very dark brown, brown, very dark gray, dark grayish brown, black, or very dark grayish brown. It is a mixture of cobbly or stony silty clay or clay and has 15 to 30 percent fragments by volume. The A12ca horizon is very dark brown to very dark grayish brown, and it ranges from 35 percent to about 80 percent coarse fragments.

These soils are moist for longer periods than is typical for the Tarrant series, and they have a black and very dark gray A1 horizon that is not within the range defined for the series. These differences do not alter use and behavior.

75—Tarrant soils, 1 to 8 percent slopes. These soils are very gently sloping to sloping. Included with these soils in mapping are about 5 percent areas of San Saba soils.

These soils are used for native grasses. They are not suited to cultivation or tame pasture because they are very shallow or shallow over limestone and have a cobbly or stony surface layer.

The main concerns in management are the depth to limestone, droughtiness, a cobbly or stony surface layer, and the hazard of erosion. Grasses do not grow well on these soils because cobbles and stones are numerous and the soils are droughty. If areas are overgrazed, grass will be replaced by undesirable plants. Preventing overgrazing, controlling weeds, and protecting the areas from fire will maintain grass for grazing. Capability unit VIIs-1; Very Shallow range site; not assigned to woodland group.

Trinity Series

The Trinity series consists of nearly level soils on flood plains. These soils formed in material weathered from clayey sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is 26 inches of black clay underlain by 12 inches of very dark gray clay. The underlying material is very dark gray clay to a depth of 60 inches.

Trinity soils are somewhat poorly drained and have very slow permeability. Available water capacity is medium. The water table ranges from 0 to 3 feet in depth during November through February. Trinity soils are subject to flooding.

Representative profile of Trinity clay, 1,720 feet north and 800 feet west of the southeast corner of sec. 18, T. 5 S., R. 11 E.:

Ap—0 to 10 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine granular structure; very hard, very firm; few very fine pieces of limestone; calcareous; moderately alkaline; gradual smooth boundary.

A12—10 to 26 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine granular and blocky structure; very hard, very firm; few fine pieces of limestone; calcareous; moderately alkaline; gradual smooth boundary.

A13—26 to 38 inches; very dark gray (N 3/0) clay, gray (N 5/0) dry; moderate fine granular and subangular blocky structure; very hard, very firm; many fine fragments of limestone; calcareous; moderately alkaline; gradual smooth boundary.

C—38 to 60 inches; very dark gray (5Y 3/1) clay, gray (5Y 5/1) dry; weak fine subangular blocky structure; very hard, very firm; many fine fragments of limestone; few fine sea shells; calcareous; moderately alkaline.

The depth to bedrock is more than 60 inches. Cracks are common during dry periods. The A1 or Ap horizon is very dark gray or black, and it ranges from mildly alkaline to moderately alkaline. In some profiles it has brownish or olive mottles. The C horizon is very dark gray, dark gray, or gray clay or silty clay. In many profiles it has brownish and olive mottles.

76—Trinity clay. This soil is nearly level and is subject to occasional flooding. Included with this soil in mapping are areas of Kaufman, Verdigris, and

Frioton soils, each making up about 5 percent of the mapped acreage.

This soil is used mostly for tame pasture. Some areas are managed for woodland.

The main concerns of management in cultivated areas are controlling flooding and surface wetness, increasing water intake, and maintaining tilth. Close-grown crops are needed late in fall, in winter, and in spring to prevent excessive erosion during flooding. Planting in spring needs to be delayed until after the period of common flooding. Most crops can be grown continuously where plant food is added that provides for maximum crop residue. A large amount of residue helps maintain organic matter content and improves tilth and intake of water. Where this soil is wet, tillage or grazing breaks down tilth and reduces water intake. A drainage system coupled with arranging rows for drainage reduces surface wetness and increases the quality and yield of crops. Capability unit IIw-4; not assigned range site; woodland group 3w.

Tullahassee Series

The Tullahassee series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is brown and dark grayish brown fine sandy loam 14 inches thick. In sequence downward, the underlying material is 10 inches of strong brown and gray sandy loam, 6 inches of strong brown sandy loam that has thin layers of dark brown loamy fine sand, and 30 inches of strong brown and gray sandy loam.

Tullahassee soils are somewhat poorly drained and have moderately rapid permeability. Available water capacity is high. The water table ranges in depth from 2 to 3 feet during November through May. Tullahassee soils are subject to flooding.

Representative profile of Tullahassee fine sandy loam, 1,700 feet north and 20 feet west of the southeast corner of sec. 36, T. 6 S., R. 13 E.:

A1—0 to 14 inches; brown (10YR 4/3) and dark grayish brown (10YR 4/2) fine sandy loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; very friable; slightly acid; clear smooth boundary.

C1—14 to 24 inches; stratified strong brown (7.5YR 5/6) and gray (10YR 5/1) sandy loam; few fine yellowish red mottles; weak fine granular structure; very friable; slightly acid; clear smooth boundary.

C2—24 to 30 inches; strong brown (7.5YR 5/6) sandy loam; thin layers of dark brown (7.5YR 5/2) loamy fine sand; common coarse prominent yellowish red (5YR 5/6) and gray (10YR 5/1) mottles; massive; very friable; thin strata of fine sandy loam and loam; few organic stains; few very fine pebbles; few fine iron and manganese concretions; saturated; slightly acid; clear smooth boundary.

C3—30 to 60 inches; stratified strong brown (7.5YR 5/6) and gray (10YR 6/1) sandy loam; common coarse distinct reddish brown (5YR 4/4) mottles; massive; very friable; thin strata of finer textures; common fine iron and manganese concretions; few fine pebbles; some organic stains; saturated; slightly acid.

The depth to bedrock is more than 60 inches. The solum is mottled in the upper 20 inches. The A1 horizon is dark grayish brown, grayish brown, dark yellowish brown, dark brown, or brown. It has brownish and grayish mottles. It ranges from medium grayish brown, strong brown, very dark grayish brown, dark gray, gray, very dark gray, light brownish gray, and pale brown, or it is mottled in yellow, brown, red, or gray. It is fine sandy loam or sandy loam and has thin strata of coarser or finer textured material, and it ranges from medium acid to slightly acid.

77—Tullahassee fine sandy loam. This soil is nearly level and is subject to frequent flooding. Included with this soil in mapping and making up 20 percent of the mapped area are areas of soils that have a profile similar to the one described as representative of the series but that does not have gray mottles in the upper 20 inches or that is very dark gray or dark gray in the upper 20 inches.

This soil is used mostly for tame pasture. A few areas are managed for woodland.

The main concerns in management are controlling flooding and wetness and maintaining tilth. Growth of tame pasture can be increased by adding plant food, preventing overgrazing, and controlling brush. If the areas are protected from fire, a good grass mulch can be maintained. A grass mulch will improve tilth and protect the soil from erosion during floods. In woodland areas, the quality of trees is improved by planting suitable species, removing inferior species, selective cutting, and protecting the areas from fire. Capability unit Vw-2; not assigned to range site; woodland group 3w.

Verdigris Series

The Verdigris series consists of nearly level soils on flood plains. These soils formed in material weathered from loamy sediment under a cover of trees and an understory of native grasses.

In a representative profile the surface layer is black silty clay loam 24 inches thick. The next layer is very dark grayish brown silty clay loam 16 inches thick. Below this is very dark grayish brown clay loam to a depth of 60 inches.

Verdigris soils are moderately well drained and have moderate permeability. Available water capacity is high. Depth to the water table is more than 6 feet. Verdigris soils are subject to flooding.

Representative profile of Verdigris silty clay loam, 530 feet east and 150 feet south of the northwest corner of sec. 7, T. 7 S., R. 11 E.:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine granular structure; hard, friable; common worm castings; neutral; gradual smooth boundary.

A1—8 to 24 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; very hard, friable; common worm castings; neutral; gradual smooth boundary.

AC1—24 to 40 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine and medium granular structure; very hard, friable; neutral; gradual smooth boundary.

AC2—40 to 60 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; few medium distinct brown (7.5YR 5/4) mottles; moderate fine and medium granular structure; very hard, firm; neutral.

The depth to bedrock is more than 60 inches. The solum ranges from neutral to medium acid. Some profiles are faintly mottled at a depth of more than 24 inches. The

A1 or Ap and AC horizons are black, very dark gray, very dark grayish brown, or very dark brown. The AC horizon is silt loam or silty clay loam. The C horizon, where present, is dark grayish brown, grayish brown, dark brown, brown, dark yellowish brown, or yellowish brown. It is a silt loam or silty clay loam. Loam and clay loam are at a depth of more than 40 inches.

78—Verdigris silty clay loam. This soil is nearly level and is subject to occasional flooding. Included with this soil in mapping are about 5 percent areas of Frioton and Kaufman soils. Also included and making up 10 percent of the mapped area is a soil similar to this Verdigris soil, but the surface layer is lighter in color.

This soil is used mostly for tame pasture, grain sorghum, wheat, soybeans, cotton, peanuts, and alfalfa hay. Sizable areas are managed for woodland.

The main concerns in management are controlling flooding and maintaining tilth. Close-grown crops are needed late in fall, in winter, and in spring to prevent excessive erosion during flooding. Planting in spring needs to be delayed until after the period of common flooding. Most crops that produce a large amount of residue can be grown continuously where plant food is added that provides for maximum crop residue. Maintenance of the organic matter content improves tilth and intake of water. Minimum tillage needs to be used. Tame pasture or woodland protects this soil during flooding. Capability unit IIw-2; not assigned to range site; woodland group 2o.

Woodson Series

The Woodson series consists of nearly level soils on uplands. These soils formed in material weathered from clayey and loamy sediment under a cover of native grasses.

In a representative profile the surface layer is very dark gray silt loam 9 inches thick. The upper part of the subsoil is black clay 30 inches thick, the middle part is very dark gray clay 11 inches thick, and the lower part is dark grayish brown clay 10 inches thick.

Woodson soils are somewhat poorly drained and have very slow permeability. Available water capacity is medium. Depth to the water table is more than 6 feet. A water table is at a depth of 0.5 foot to 2.0 feet during December through April.

Representative profile of Woodson silt loam, 0 to 1 percent slopes, 2,390 feet east and 150 feet north of the southwest corner of sec. 12, T. 7 S., R. 8 E.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate granular structure; hard, friable; slightly acid; abrupt smooth boundary.

B21t—9 to 25 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate fine blocky structure; very hard, very firm; silt coats on faces of peds; slightly acid; gradual smooth boundary.

B22t—25 to 39 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; few medium distinct dark grayish brown (2.5Y 4/2) mottles; moderate fine blocky structure; very hard, very firm; material from Ap horizon in a few cracks; few very small fragments; thin clay films on faces of peds; neutral; gradual smooth boundary.

B23t—39 to 50 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine blocky structure; very hard, very firm; many fine streaks of gypsum; few very fine fragments; clay films on faces of peds; neutral; gradual smooth boundary.

B3—50 to 60 inches; dark grayish brown (2.5Y 4/2) clay, grayish brown (10YR 5/2) dry; common coarse distinct olive yellow (2.5Y 6/6) mottles; moderate fine and medium blocky structure; very hard, very firm; thin patchy clay films; many fine seams of gypsum; few very fine fragments; few fine calcium carbonate concretions; neutral.

The depth to bedrock is more than 60 inches. The A1 or Ap horizon is black or very dark gray. It ranges from medium acid to slightly acid. The B2t horizon is dark gray, very dark gray, gray, or black and has brownish, grayish, or reddish mottles. It ranges from neutral to medium acid. In many areas this horizon has calcium carbonate concretions. The B3 horizon is gray, dark gray, very dark gray, pale brown, brown, dark grayish brown, grayish brown, pale olive, olive gray, or olive. It has brownish, grayish, yellowish, or reddish mottles. It ranges from slightly acid to mildly alkaline.

79—Woodson silt loam, 0 to 1 percent slopes. This soil is nearly level. Included with this soil in mapping are areas of Dennis, Durant, and Parsons soils, each making up less than 4 percent of the mapped acreage.

This soil is used mainly for wheat, soybeans, grain sorghum, peanuts, cotton, and tame pasture. A few small areas are managed for native grass.

The main concerns in management are maintaining tilth, increasing intake of water, and controlling surface crusting, seasonal wetness or droughtiness, and erosion on long slopes. This soil can be used continuously for clean-tilled crops where adequate plant food is added and where crop residue is returned to the soil. A large amount of crop residue maintains organic matter content and tilth, increases water intake, and prevents surface crusting. Winter cover crops furnish protection against erosion. In a few areas, diversion terraces on long slopes can be used to reduce erosion. A drainage system coupled with arranging rows for drainage reduces surface wetness and improves crop production. Tillage should be timely and kept to a minimum. Capability unit IIs-1; Claypan Prairie range site; not assigned to woodland group.

Woodtell Series

The Woodtell series consists of very gently sloping to gently sloping soils on uplands. These soils formed in material weathered from loamy and clayey sediment under a cover of trees and an understory of grasses.

In a representative profile the surface layer is very dark grayish brown loam 6 inches thick. The upper part of the subsoil is dark reddish brown clay 11 inches thick, the middle part is olive gray clay 24 inches thick, and the lower part is coarsely mottled olive gray and red clay 22 inches thick.

Woodtell soils are moderately well drained and have very slow permeability. Available water capacity is medium. A water table is at a depth of 1.5 to 4.0 feet during December through February.

Representative profile of Woodtell loam, 2 to 5 percent slopes, 2,320 feet west and 60 feet south of the northeast corner of sec. 15, T. 8 S., R. 10 E.:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; hard, friable; medium acid; abrupt wavy boundary.

B21t—6 to 17 inches; dark reddish brown (5YR 3/4) clay, reddish brown (5YR 4/4) dry; strong fine blocky structure; very hard, very firm; clay films on faces of peds; extremely acid; gradual smooth boundary.

B22t—17 to 41 inches; olive gray (5Y 5/2) clay, light olive gray (5Y 6/2) dry; many coarse prominent red (2.5YR 4/6) mottles moist; moderate fine and medium subangular blocky structure; very hard, very firm; thin clay films on faces of peds; extremely acid; gradual smooth boundary.

B3—41 to 63 inches; coarsely mottled olive gray (5Y 5/2) and red (2.5YR 4/6) clay; weak coarse subangular blocky structure; very hard, very firm; patchy clay films on faces of peds; very strongly acid in upper part and medium acid at a depth of more than 50 inches.

Solum thickness and depth to bedrock are more than 60 inches. Wide cracks are common during dry periods. The Ap or A1 horizon is very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. It ranges from medium acid to strongly acid. An A2 horizon less than 4 inches thick is in some profiles. The B21t horizon is red, dark reddish brown, reddish brown, yellowish red, brown, or strong brown. It is clay loam, silty clay loam, or clay and ranges from strongly acid to extremely acid. The B22t horizon is brown, dark yellowish brown, yellowish brown, grayish brown, light olive brown, olive gray, or olive. It is mottled in shades of red, gray, or yellow. It is clay loam, silty clay loam, or clay and ranges from strongly acid to extremely acid. The B3 horizon is yellowish brown, light olive brown, grayish brown, olive, olive gray, or it is mottled in places in shades of red, yellow, brown, gray, or olive. It ranges from very strongly acid to strongly acid in the upper part and from medium acid to mildly alkaline at a depth of more than 50 inches.

These soils have slightly lower chroma in the subsoil than is defined in the range for the Woodtell series, and they have a thicker solum. These differences do not affect use, behavior, or management.

80—Woodtell loam, 2 to 5 percent slopes. This soil is very gently sloping to gently sloping. Included with this soil in mapping are about 7 percent areas of Boxville soils and about 5 percent areas of Durant soils.

This soil is used mostly for tame pasture. A sizable acreage is managed for woodland. The main cultivated crop is wheat.

The main concerns in management are protecting the soil from soil blowing and erosion and maintaining tilth and fertility. A cropping system using mostly small grain and amounts of plant food that provide for maximum residue is needed to control erosion. Row crops should be avoided to prevent excessive erosion. Terraces, waterways, and contour farming also help to protect the soil. Tame pasture and legumes and additions of plant food reduce soil erosion. Capability unit IVe-2; not assigned to range site; woodland group 4c.

Planning the Use and Management of Soils[2]

The soil survey is a detailed analysis and evaluation of the most basic resource of the survey—the soil. It may be used to fit the use of the land, including urbanization, to the limitations and potentials of the natural resources and the environment and to help avoid soil-related failures in uses of the land.

[2]By THEODORE B. LEHMAN, conservation agronomist, Soil Conservation Service.

During a soil survey soil scientists, conservationists, engineers, and others keep extensive notes, not only about the nature of the soils but also about unique aspects of behavior of these soils in the field and at construction sites. These notes include observations of erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic systems, and other factors relating the kinds of soil and their productivity, potentials, and limitations under various uses and management. In this way field experience incorporated with measured data on soil properties and performance is used as a basis for predicting soil behavior.

Information in this section will be useful in applying basic facts about the soils to plants and decisions for use and management of soils for crops and pasture, range, woodland, and many nonfarm uses, including building sites, highways and other transportation systems, sanitary facilities, parks and other recreational developments, and wildlife habitat. From the data presented, the potential of each soil for specified land uses may be determined, soil limitations to these land uses may be identified, and costly failures in homes and other structures, because of unfavorable soil properties may be avoided. A site can be selected where the soil properties are favorable, or practices can be planned that will overcome the soil limitations.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area, and on the environment. Both of these factors are closely related to the nature of the soil. Plans can be made to maintain or create a land use pattern in harmony with the natural soil.

Contractors can find information useful in locating sources of sand and gravel, road fill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, trees and shrubs, and most other uses of land are influenced by the nature of the soil.

Management of the Soils for Cultivated Crops

Cultivated soils in this county need management that will conserve moisture, control erosion, maintain fertility, supply organic matter, and provide good tilth. Some of the management practices that are suitable for the soils in the county are discussed in this section. For combinations of practices for specific soils, see "Descriptions of the Soils."

The information in this section can be used with that in the descriptions of the mapping units to help the farmer and rancher select appropriate practices for specific soils. Most suitable management practices accomplish more than one purpose and can be used on nearly all the cropland in the county.

Before establishing crops, the soils should be worked to prepare a seedbed, to control weeds, and to provide

a place for the growth of plant roots. Excessive tillage breaks down tilth and speeds up the decomposition of organic matter. The soils then tend to puddle and crust at the surface, take in less water and air, and store less moisture for plant growth.

Minimum tillage is accomplished by (1) using a long-term cropping system that has perennial grasses or deep-rooted legumes, (2) using herbicides instead of cultivation for weed control, and (3) reducing the number of operations in preparing the seedbed, in planting, and in cultivating.

Crop residue management.—Leaving crop residue on the surface during winter and spring, or working it partly into the surface, is needed to protect soils from erosion. Organic matter, or humus, supplied by crop residue improves the tilth of the surface layer. The improved tilth then increases infiltration and storage of water, reduces the hazard of erosion, and helps to prevent crusting.

Soil-improving crops.—The main objectives in using soil-improving crops are to maintain or improve the physical condition and the productivity of the soil and to control erosion, weeds, insects, and diseases. A cropping system that improves the soil includes crops that produce large amounts of residue.

Crop residue and weeds are sources of organic material for maintenance of fertility and tilth. This residue needs the addition of plant food to prevent a shortage of nutrients for the succeeding crop.

Soil-depleting crops.—Crops that do not help to control erosion, improve tilth, or build up the organic matter content are soil depleting. Minimum use of these crops is made in a good cropping system. Clean-tilled crops are soil depleting if the forage is removed for silage or cut low for bundle feed or hay, if soybeans are cut for hay, or if most of the top growth is removed each year.

Cover crops.—Cover crops generally consist of small grain and vetch grown to improve tilth and protect the soil from erosion. Small grain and vetch are suitable cool-season cover crops.

Grassed waterways.—Grassed waterways are mainly broad, flat-bottomed channels that are seeded or sodded with perennial plants. Bermudagrass or native grasses are commonly used. Grassed waterways are needed for terrace outlets to provide safe disposal of excess water. They are also used with diversion terraces and in natural drainageways.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. This classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering purposes.

In the capability system, all kinds of soils are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial plants. (None in Bryan County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* and *c,* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-2.

In the following pages the capability units in Bryan County are described. The capability classification of an individual mapping unit is given in two places: at

the end of the mapping unit description in the section "Descriptions of the Soils," and in the Guide to Mapping Units, which is at the back of this publication.

Unit I-1. Deep, nearly level, well drained fine sandy loams, silt loams, and silty clay loams; on flood plains.

Unit I-2. Deep, nearly level, moderately well drained and well drained fine sandy loams, loams, and silt loams; on uplands.

Unit IIe-1. Shallow to deep, very gently sloping, moderately well drained and well drained fine sandy loams, loams, and silt loams; on uplands.

Unit IIe-2. Deep, very gently sloping, moderately well drained and well drained fine sandy loams and silt loams; on uplands.

Unit IIe-3. Deep and moderately deep, very gently sloping, moderately well drained and well drained silty clay loams and clays; on uplands.

Unit IIw-1. Deep, nearly level, somewhat poorly drained silty clay loams; on flood plains.

Unit IIw-2. Deep, nearly level, moderately well drained and well drained fine sandy loams, loams, and silty clay loams; on flood plains.

Unit IIw-3. Deep, nearly level, moderately well drained clays; on uplands.

Unit IIw-4. Deep, nearly level, somewhat poorly drained clays; on flood plains.

Unit IIs-1. Deep, nearly level, somewhat poorly drained silt loams; on uplands.

Unit IIs-2. Deep, nearly level, somewhat poorly drained clays; on flood plains.

Unit IIs-3. Deep, nearly level, moderately well drained clays; on flood plains.

Unit IIIe-1. Deep, very gently sloping, well drained loamy fine sands; on uplands.

Unit IIIe-2. Deep, very gently sloping to gently sloping, moderately well drained and well drained fine sandy loams and loams; on uplands.

Unit IIIe-3. Deep, gently sloping, moderately well drained and well drained clays; on uplands.

Unit IIIe-4. Deep, very gently sloping to gently sloping, moderately well drained and well drained fine sandy loams and silt loams; on uplands.

Unit IIIe-5. Deep and moderately deep, very gently sloping to gently sloping, moderately well drained and well drained fine sandy loams and silt loams; on uplands.

Unit IIIw-1. Deep, nearly level, poorly drained silt loams; on flood plains.

Unit IIIs-1. Deep, nearly level to strongly sloping well drained fine sandy loams, silty clay loams, and fine sands; on flood plains.

Unit IIIs-2. Deep, nearly level to very gently sloping, well drained loamy fine sands; on uplands.

Unit IVe-1. Deep, gently sloping to sloping, well drained loamy fine sands and cobbly loamy fine sands; on uplands.

Unit IVe-2. Deep, very gently sloping to sloping, moderately well drained and well drained fine sandy loams and loams; on uplands.

Unit IVe-3. Deep, very gently sloping to gently sloping, moderately well drained and well drained loams and clays; on uplands.

Unit Vw-1. Deep, nearly level, moderately well drained and somewhat poorly drained clays; on flood plains.

Unit Vw-2. Deep, nearly level, well drained and somewhat poorly drained loamy fine sands, fine sandy loams, and very fine sandy loams; on flood plains.

Unit VIe-1. Shallow, moderately deep and deep, very gently sloping to moderately steep, well drained clays and cobbly and stony silty clays; on uplands.

Unit VIe-2. Deep, strongly sloping to moderately steep, well drained loamy fine sands and cobbly loamy fine sands; on uplands.

Unit VIe-3. Deep, sloping to moderately steep, moderately well drained and well drained fine sandy loams and clays; on uplands.

Unit VIe-4. Deep, nearly level to gently sloping, moderately well drained silt loams and silty clay loams; on uplands and flood plains.

Unit VIe-5. Deep, very gently sloping to sloping, moderately well drained and well drained fine sandy loams and loams; on uplands.

Unit VIe-6. Deep, gently sloping to moderately steep, somewhat excessively drained fine sands; on uplands.

Unit VIs-1. Shallow, gently sloping to strongly sloping, well drained to somewhat excessively drained fine sandy loams; on uplands.

Unit VIIs-1. Shallow, very gently sloping to sloping, well drained cobbly clays; on uplands.

Unit VIIs-2. Pits that have the subsoil and underlying material exposed at the surface; on uplands.

Yields per acre

The per acre average yields that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in table 4 because of seasonal variations in rainfall and other climatic factors. Absence of a yield estimate indicates that the crop is not suited to or not commonly grown on the soil.

The predicted yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The latest soil and crop management practices used by many farmers in the county are assumed in predicting the yields. Hay and pasture yields are predicted for varieties of grasses and legumes suited to the soil. A few farmers may be using more advanced practices and are obtaining average yields higher than those shown in table 4.

TABLE 4.—*Yields per acre of crops*

[All yields were estimated for a high level of management. Absence of a yield figure indicates the crop is seldom grown or is not suited to the soil]

Soil name and map symbol	Wheat	Grain sorghum	Soybeans	Cotton	Peanuts	Alfalfa hay
	Bu	*Bu*	*Bu*	*Lb*	*Lb*	*Tons*
Bates: 1	30	50	25	400	1,500	
Bernow:						
2	20	35	15		1,000	
3	30	55	25	450	1,400	
4	25	50	20	400	1,300	
5	20					
6						
[1]7	20					
[1]8	20	30	15		1,000	
[1]9						
10						
Bosville:						
11	25					
12						
Boxville:						
13	30	50	25	400	1,300	
14	25					
Burleson:						
15	35	65	30	450		
16	32	55	25	400		
17	30	45		250		
Catoosa: [1]18	30	45	24	350	1,300	
Collinsville: 19						
Crockett:						
20	28	48	25	300	900	
[1]21	24					
22						
Dennis:						
23	42	65	35	500	1,600	4.5
24	38	62	32	450	1,500	
25	34	55	28	375	1,200	
Durant:						
26	32	50	30	400	1,200	
27	30	40	26	350	1,000	
[1]28						
Eufaula: 29						
Ferris:						
30	24					
31						
[1]32						
[1]33						
Fitzhugh:						
34	27	48	20	375	1,300	
[1]35	20					
Freestone: 36	26	50	18	350	1,300	
Frioton: 37	34	66	30	450	1,600	4.0
Gowton: 38	35	68	30	425	1,650	4.0
Guyton: 39	32	54	25	400	1,200	
Heiden:						
40	30	48		350		
41						

TABLE 4.—*Yields per acre of crops*—Continued

Soil name and map symbol	Wheat	Grain sorghum	Soybeans	Cotton	Peanuts	Alfalfa hay
	Bu	*Bu*	*Bu*	*Lb*	*Lb*	*Tons*
Karma:						
42	36	60	32	450	1,500	
43	32	55	28	400	1,300	
44	27					
45						
Kaufman:						
46	36	68	31	500		
47						
Kiomatia:						
[2]48	36	40	30	450	1,600	
[2]49	28	34	23	350	1,200	
50						
Larton:						
51	20	35	20		1,200	
52	18	30	18		1,100	
Larue: 53	22	37	20		1,200	
Madill: 54	32	62	28	400	1,600	3.5
Matoy: 55	30	48	26	380		
Muldrow: 56	30	47	30	450		
Muskogee:						
57	32	58	28	400	1,450	4.5
58	33	56	30	400	1,300	
59	30	53	25	375	1,200	
60	25					
Norwood: [2]61	48	70	40	680	1,800	5.5
Okay:						
62	38	65	35	475	1,600	4.0
63	42	63	35	500	1,680	4.0
64	36	62	32	450	1,550	3.5
Oklared:						
[2]65	40	64	36	650	1,800	5.0
66	38	62	34	600	1,700	5.0
Parsons: 67	32	50	26	450	1,200	
Pits: 68						
Pledger: 69	36	68	30	550		
Redport: [2]70	46	66	38	680	1,680	5.5
San Saba: [1]71						
Severn: [2]72	46	68	40	700	1,850	5.5
Ships:						
73	42	68	34	550		4.5
74						
Tarrant: 75						
Trinity: 76	36	68	32	450		
Tullahassee: 77						
Verdigris: 78	36	70	32	425	1,700	4.5
Woodson: 79	35	56	26	500	1,400	
Woodtell: 80	34					

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.
[2]Yields are for areas protected from flooding.

The management needed to achieve the indicated yields of the various crops depends upon the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace of elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The predicted yields reflect the relative productive capacity of the soils for each of the principal crops. Yields are likely to increase in the future as new production technology is developed. The relative productivity of a given soil compared to other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but because their acreage is small, predicted yields for these crops are not included. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the productivity and management concerns of the soils for these crops.

Management of the Soils for Tame Pasture

General guidelines for managing soils for pasture are described in this section. Detailed information about the management of specific soils is given in the section, "Descriptions of the Soils."

Much of the acreage in Bryan County is in pasture. Pasture plants are grown on all soils. The trend is to convert cropland and some areas of woodland to pasture.

The main grasses are improved bermudagrass and lovegrass. Bermudagrass is generally overseeded in a mixture with legumes, such as annual lespedeza and yellow hop clover. A bermudagrass-legume mixture is the main summer pasture vegetation. Improved varieties of bermudagrass under good management produce more forage than common bermudagrass. Bermudagrass is well suited to most of the soils. Winter rye and vetch, when overseeded on bermudagrass, provide grazing late in fall and early in spring. Sudan and sorghum hybrids are used for temporary summer pasture where perennial forages are in short supply. Fall-sown small grain, such as winter wheat or rye, is sometimes used for fall, winter, and spring grazing as a supplement to native and perennial tame pasture plants. Sudangrass and switchgrass can be used as a supplement during summer.

Weeping lovegrass is better suited to the sandy soils, such as those in the Eufaula and Larton series, and yields are comparable to those of bermudagrass on loamy soils. Weeping lovegrass provides summer grazing, but it must be well managed or it becomes unpalatable.

Other common tame pasture grasses are King Ranch bluestem and tall fescue. King Ranch bluestem is suited to the more clayey soils, such as those in the Burleson or Woodson series. It is more difficult to establish but is more drought resistant than bermudagrass. Tall fescue is suited to the deep bottom land soils and grows well on the wetter soils, such as those in the Tullahassee or Trinity series. It provides grazing early in spring and late in fall.

In figure 9 the percentage of forage yield for grazing is listed by grass or crop by months. In table 5, the estimated grazing yields per acre are listed by grass for each mapping unit.

Management and maintenance

Prevention of overgrazing helps to lengthen the life of most pastures. Fescue pasture needs to be rested. This permits the plants to regain vigor and allows the root system to remain in condition to produce needed forage.

Brush control is essential, especially on wooded soils. Applying moderate amounts of plant food that contains the proper elements provides for more vigorous plants and more palatable forage. It also helps to increase production and lengthen the lifespan of the pasture. Some legumes, such as Ladino clover, require more phosphate and lime than others, such as yellow hop clover and lespedeza. Commonly, where grass is grown without legumes, larger amounts of nitrogen plant food are needed.

Tame pasture plant yields

Yields of tame pasture plants are given in table 5. Grazing data in this table for any given year are estimated in terms of animal-unit-months (A.U.M.). The amount of forage can be calculated on a monthly basis by multiplying the percentage of yield shown in figure 9 times the total A.U.M. shown in table 5. A grazing program can be planned by adjusting the various kinds of tame pasture plants to the total A.U.M. grazing needs for each month.

Use of the Soils for Rangeland

This section contains information about the use of the soils for rangeland. Rangeland is land on which the natural plant community is composed mainly of grass, grasslike plants, forbs, and shrubs valuable for grazing and in sufficient quantity to justify grazing use. About 15 percent of the soils in Bryan County are in native range on which domestic animals are raised. The range is usually grazed year-round, but during the dormant season the forage is supplemented by protein and hay or tame pasture.

Descriptions of the range sites

In the following pages, the range sites of Bryan County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

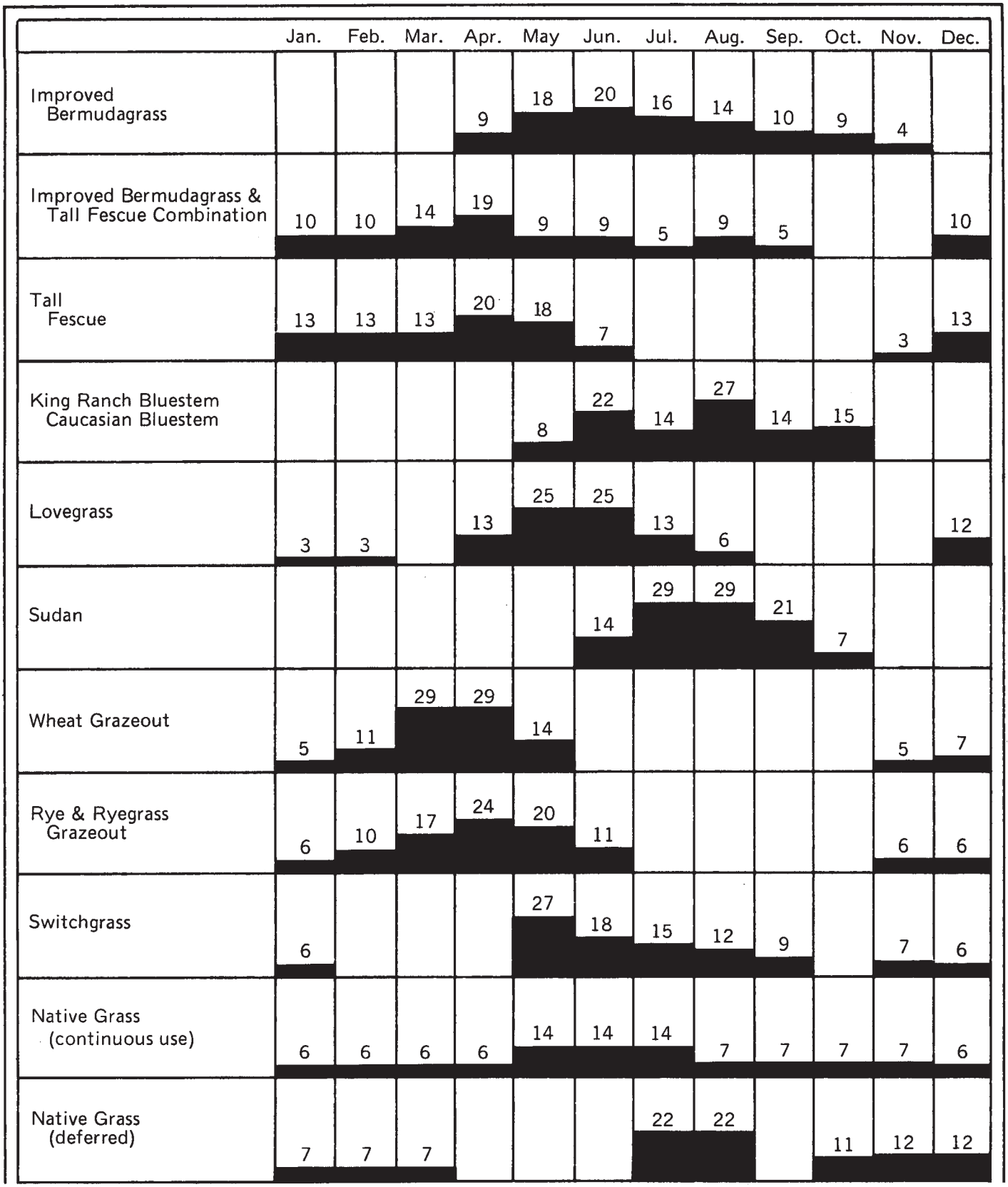

Figure 9.—**Percentage of annual forage yield available for grazing each month.**

TABLE 5.—*Grazing yields per acre*

[All yields were estimated for a high level of management. Absence of a yield indicates the pasture is seldom grown or is not suited]

Soil name and map symbol	Wheat grazeout	Rye and ryegrass grazeout	Sudangrass	Improved bermudagrass	Tall fescue	Weeping lovegrass	Switchgrass	King Ranch bluestem
	AUM[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]
Bates: 1	3.8	4.3	3.8	6.0		7.0	2.3	
Bernow:								
2	3.2	3.7	2.4	6.0		6.5	2.3	
3	3.8	4.3	3.6	7.5		7.5	1.9	
4	3.6	4.1	2.5	7.0		7.5	1.7	
5	3.2	3.7	2.4	6.0		7.0	1.7	
6				5.0		5.0	2.2	
[2]7	3.2	3.2		5.5		5.5		
[2]8	3.2	3.2		5.5		6.0		
[2]9				5.0		5.5		
10				4.5				
Bosville:								
11	3.6	4.1	2.4	6.5		6.0	1.9	
12				6.0		5.5	1.7	
Boxville:								
13	3.8	4.3	3.0	7.0		7.0	1.9	
14	3.6	4.1		6.5		6.5	1.7	
Burleson:								
15	4.3	3.8		6.5	6.0		2.0	5.5
16	4.0	3.8		5.5	5.0		2.5	4.5
17	3.8	3.5		5.0	4.5		1.9	4.0
Catoosa: [2]18	3.8	3.8		5.5		6.5	1.9	
Collinsville: 19				4.0		4.5		
Crockett:								
20	3.6	3.8	3.0	6.0		6.0	1.5	
[2]21	3.6	3.8		6.0		6.0	1.9	
22				4.0				
Dennis:								
23	4.7	4.2	4.0	7.5	6.5	8.0	2.3	
24	4.5	4.6	3.8	7.0	6.0	7.5	2.1	
25	4.3	4.5	2.5	6.5		7.0	2.0	
Durant:								
26	4.0	4.1	3.6	6.0		6.5	1.9	
27	3.8	4.0	2.5	5.5		6.0	1.7	
[2]28				5.5	5.5	6.0		
Eufaula: 29				4.0		5.0		
Ferris:								
30	3.6	3.4		4.5	4.0		1.5	4.0
31				4.5				4.0
[2]32				4.5				4.0
[2]33				4.0				3.5
Fitzhugh:								
34	3.6	4.1		6.5		7.0	1.9	
[2]35	3.2	3.2		6.0		6.0	2.1	
Freestone: 36	3.6	4.3	3.0	7.5	7.5		1.9	
Frioton: 37	4.3	4.1		7.5	7.0		2.9	
Gowton: 38	4.3	4.3		7.5	7.0		3.0	
Guyton: 39	4.0	3.8		6.0	7.0		2.5	
Heiden:								
40	3.8	3.3		5.5	4.5		1.9	4.5
41				4.0				3.5

TABLE 5.—*Grazing yields per acre*—Continued

Soil name and map symbol	Wheat grazeout	Rye and ryegrass grazeout	Sudangrass	Improved bermudagrass	Tall fescue	Weeping lovegrass	Switchgrass	King Ranch bluestem
	AUM[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]	*AUM*[1]
Karma:								
42	4.3	4.8	3.6	7.0	6.0	8.0	2.3	
43	4.6	5.1	2.5	6.5		7.0	1.9	
44	3.6	4.1	2.5	6.5		7.0	1.9	
45				5.5		6.0		
Kaufman:								
46	4.5	4.0		7.5	7.0		2.6	
47				6.5	7.0		1.5	
Kiomatia:								
48	4.3	4.8		6.5	5.5	7.0	2.0	
[2]49	3.2	3.2		5.5	5.0	6.5	2.1	
50				6.5	6.5	7.0	1.7	
Larton:								
51	3.2	3.7	2.8	5.5		6.5	2.0	
52	3.0	3.5	2.4	5.5		6.5	1.7	
Larue: 53	3.4	3.9		5.5		6.5	2.2	
Madill: 54	5.0	5.5		7.0	6.5		3.0	
Matoy: 55	3.8	3.6		6.0	5.0		2.3	5.0
Muldrow: 56	3.8	3.6		8.0	7.5		2.8	
Muskogee:								
57	4.0	4.0		7.0	6.0	7.5	2.3	
58	4.0	4.0		6.5	5.5	7.0	2.1	
59	3.8	3.8		6.0		6.5	2.0	
60	3.6	3.8		6.0		6.0	1.7	
Norwood: 61	5.0		4.0	8.5	7.0	8.5	2.3	
Okay:		5.0						
62	4.5		3.8	7.5	6.5	8.0	2.3	
63	4.7	5.0	4.0	7.5	6.5	8.0	2.3	
64	4.3	5.2	3.8	7.0		7.5	2.3	
Oklared:		4.3						
65	4.7	5.2	4.0	7.5	6.5	8.0	2.3	
66	4.5	4.5		7.5	6.5	7.5	2.3	
Parsons: 67	4.0	3.8		6.0	5.5		1.6	5.0
Pits: 68				3.0				
Pledger: 69	4.3	3.8		7.0	7.0		2.5	
Redport: 70	5.0	5.0		7.5	7.0		2.3	
San Saba: [2]71				4.5	4.0			3.5
Severn: 72	5.0	5.5	4.0	8.0	7.0	8.5	2.3	
Ships:								
73	4.7	4.2		7.0	7.0		2.5	
74				7.0			1.5	
Tarrant: 75								
Trinity: 76	4.3	3.8		7.0	7.0		2.6	
Tullahassee: 77				8.0	7.5		1.7	
Verdigris: 78	4.3	4.1		7.5	7.5		3.2	
Woodson: 79	4.3	4.1		6.0	6.0		1.6	5.0
Woodtell: 80	3.6	3.6		5.5		6.0	1.7	

[1]AUM (animal-unit-month) is a term used to express the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, five goats) for a period of 30 days.

[2]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the behavior and composition of the whole mapping unit.

A range site supports a distinctive potential plant community, or combination of plants, that can grow on a site that has not undergone major disturbance. Soils that produce the same kind, amount, and proportion of range plants are grouped into range sites. Range sites can be interpreted directly from the soil map, where the relationships between the soils and vegetation have been correlated. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on range plants and their productivity. Reaction, salt content, and a seasonal high water table are also important.

Specific information about stocking range sites is not included in this publication. Help in classifying range sites in estimating the condition of the range, and in determining the number of animals to stock can be obtained from technicians of the local agricultural agencies.

BLACKCLAY PRAIRIE RANGE SITE

This site consists of deep or moderately deep, nearly level to moderately steep, clayey or loamy soils that have a clayey or loamy subsoil.

Under continued heavy grazing, little bluestem, big bluestem, indiangrass, and eastern gramagrass decrease in the plant community. Such plants as hairy grama, side-oats grama, Scribner panicum, meadow dropseed, and prairie sagewort increase. If overgrazing is prolonged, Japanese brome, annual three-awn, silver bluestem, western ragweed, ironweed, and annual forbs make up a substantial part of the annual production and total production is greatly reduced.

Range management practices that are practical on this site are deferred grazing, fencing, a planned system of grazing, stockwater development, range seeding, and weed management.

CLAYPAN PRAIRIE RANGE SITE

This site consists of deep, nearly level to gently sloping, loamy upland soils that have a clayey subsoil and of a few soils that have a loamy subsoil.

Under continued heavy grazing, little bluestem, big bluestem, switchgrass, and indiangrass will decrease in the plant community. Such plants as side-oats grama, hairy grama, buffalograss, silver bluestem, and prairie sagewort will increase. If overgrazing is prolonged, annual three-awn, little barley, Japanese brome, lanceleaf ragweed, pricklypear, annual broomweed, and mesquite make up a substantial part of the annual production and the total production is greatly reduced.

Range management practices that are practical on this site are a planned system of grazing, deferred grazing, range seeding, fencing, stock-water development, and weed management.

DEEP SAND SAVANNAH RANGE SITE

This site consists of deep, gently sloping to moderately steep, sandy upland soils that have a sandy subsoil.

Under continued heavy grazing, little bluestem, big bluestem, and indiangrass will decrease in the plant community. Such plants as side-oats grama, hairy grama, purpletop, Scribner panicum, and fringeleaf paspalum will increase. If overgrazing is prolonged, broomsedge bluestem, split-beard bluestem, sand dropseed, showy partridgepea, annual three-awn, oak species, and winged elm make up a substantial part of the annual production and the total production is greatly reduced.

Range management practices that are practical on this site are a planned system of grazing, deferred grazing, range seeding, fencing, stock-water development, and weed and brush management.

ERODED CLAY RANGE SITE

This site consists of deep, very gently sloping to sloping, loamy, severely eroded upland soils that have a clayey subsoil.

Under continued heavy grazing, little bluestem and side-oats grama will decrease in the plant community. Such plants as hairy grama, Texas grama, buffalograss, silver bluestem, and other forbs will increase. If overgrazing is prolonged, Japanese brome, annual three-awn, annual broomweed, and other annuals make up a substantial part of the annual production and total production is greatly reduced.

Range management practices that are practical on this range site are a planned system of grazing, deferred grazing, range seeding, fencing, and stockwater development.

LOAMY PRAIRIE RANGE SITE

This site consists of deep or moderately deep, nearly level to sloping, loamy upland soils that have a loamy and clayey subsoil. A few shallow soils are also included.

Under continued heavy grazing, little bluestem, big bluestem, indiangrass, and switchgrass will decrease in the plant community. Such plants as side-oats grama, tall dropseed, buffalograss, and perennial forbs will increase. If overgrazing is prolonged, splitbeard bluestem, broomsedge bluestem, silver bluestem, common broomweed, western ragweed, and other annual forbs make up a substantial part of the annual production and total production is reduced.

Range management practices that are practical on this range site are a planned system of grazing, range seeding, deferred grazing, fencing, stockwater development, and weed management.

LOAMY SAVANNAH RANGE SITE

This site consists of mostly deep, nearly level to gently sloping, loamy upland soils that have a loamy and clayey subsoil, but a few soils are strongly sloping to moderately steep.

Under continued heavy grazing, big bluestem, indiangrass, and little bluestem will decrease in the plant community. Such plants as tall dropseed, beaked panicum, Scribner panicum, and purpletop will increase. If overgrazing is prolonged, broomsedge bluestem, splitbeard bluestem, annual brome, annual three-awn, narrowleaf sumpweed, bitter sneezeweed, ironweed,

and other perennial forbs make up a substantial part of the annual production and total production is reduced.

Range management practices that are practical on this range site are a planned system of grazing, range seeding, deferred grazing, fencing, stockwater development, and brush and weed management.

SANDY SAVANNAH RANGE SITE

This site consists of deep, nearly level to moderately steep, sandy upland soils that have a loamy subsoil.

Under continued heavy grazing, indiangrass, little bluestem, switchgrass, and big bluestem will decrease in the plant community. Such plants as tall dropseed, hairy grama, purpletop, Scribner panicum, and sideoats grama will increase. If overgrazing is prolonged, broomsedge bluestem, splitbeard bluestem, sand dropseed, gummy lovegrass, annual brome, showy partridgepea, bitter sneezeweed, and brush make up a substantial part of the annual production and total production is reduced.

Range management practices that are practical on this range site are a planned system of grazing, range seeding, deferred grazing, fencing, stockwater development, and brush and weed management.

SHALLOW PRAIRIE RANGE SITE

This site consists of shallow, nearly level to strongly sloping, loamy upland soils that have a loamy subsoil.

Under continued heavy grazing, little bluestem, big bluestem, and indiangrass will decrease in the plant community. Such plants as tall grama, hairy grama, side-oats grama, and tall dropseed will increase. If overgrazing is prolonged, annual three-awn, annual brome, silver bluestem, Texas grama, annual broomweed, bitter sneezeweed, and other annual forbs make up a substantial part of the annual production and total production is reduced.

Range management practices that are practical on this range site are a planned system of grazing, range seeding, deferred grazing, fencing, stockwater development, and brush and weed management.

VERY SHALLOW RANGE SITE

This site consists of shallow, very gently sloping to moderately steep, cobbly or stony clayey upland soils that have a cobbly or stony clayey subsoil.

Under continued heavy grazing, little bluestem and side-oats grama will decrease in the plant community. Such plants as hairy grama, Texas grama, Texas wintergrass, tall grama, silver bluestem, and shrubs will increase. If overgrazing is prolonged, annual three-awn, annual brome, annual broomweed, bitter sneezeweed, and other annual forbs make up a substantial part of the annual production and total production is reduced.

Range management practices that are practical on this range site are a planned system of grazing, fencing, and stockwater development.

Range productivity

Where the climate and topography of different areas of range are about the same, differences in the kind and amount of vegetation are related closely to the different kinds of soil. Effective management of these areas is based on consideration of the relationship between soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the potential annual production of herbage in favorable, normal, and unfavorable years; the names of major plant species; and the percentage of each species in the composition of the potential plant community.

Potential production refers to the amount of herbage that can be expected to grow on well-managed range that is supporting the potential plant community. It is expressed in pounds per acre of air-dry herbage for favorable, normal, and unfavorable years. A favorable year is one in which the temperatures and the amount and distribution of precipitation result in growing conditions substantially better than average; a normal year is one in which these conditions are about average for the area; an unfavorable year is one in which growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry herbage produced per acre each year by the potential plant community. All herbage, both that which is highly palatable and that which is unpalatable to livestock, is included. Some of the herbage also may be grazed extensively by wildlife and some of it not.

The *common plant name* is listed for each of the grasses, forbs, and shrubs that make up most of the potential plant community on each soil.

Under the heading, *Composition,* the proportion of each species is presented as the percentage, in dry-weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the season when the forage is grazed. All of the herbage produced is normally not used.

Range management requires, in addition to knowledge of the kind of soil and the potential plant community, an evaluation of the present condition of the range vegetation in relation to its potential production. Range condition is an expression of how the present plant community compares with the potential plant community on a particular kind of soil and range site. The more nearly alike the present kinds and amounts of plants and the potential plant community, the better the range condition. The common objective in range management is to manage grazing so that the plants growing on a site are about the same in kind and amount as the potential native plant community for that site. Such management generally results in the maximum production of herbage, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential fits grazing needs, provides wildlife habitat, or provides other benefits, as well as protecting soil and water resources.

TABLE 6.—*Range productivity and composition*

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		*Pct*
Bates: 1	Loamy prairie	Favorable	7,000	Big bluestem	35
		Normal	5,000	Little bluestem	25
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	5
				Other perennial grasses	10
Bernow: [1]8, [1]9:					
Romia part	Sandy savannah	Favorable	4,500	Indiangrass	10
		Normal	3,600	Little bluestem	20
		Unfavorable	2,800	Big bluestem	15
				Switchgrass	5
				Tall dropseed	5
				Scribner panicum	5
				Other perennial forbs	5
				Other perennial grasses	15
				Other trees	20
Boxville: 13, 14	Loamy savannah	Favorable	5,200	Big bluestem	25
		Normal	3,400	Indiangrass	15
		Unfavorable	2,400	Little bluestem	10
				Beaked panicum	5
				Other trees	5
				Other perennial grasses	20
				Other perennial forbs	10
				Other shrubs	10
Burleson: 15, 16, 17	Blackclay prairie	Favorable	7,000	Little bluestem	30
		Normal	5,200	Indiangrass	15
		Unfavorable	4,000	Big bluestem	20
				Meadow dropseed	5
				Other perennial grasses	20
				Other perennial forbs	5
				Eastern gamagrass	5
Catoosa: [1]18:					
Catoosa part	Loamy prairie	Favorable	6,500	Little bluestem	25
		Normal	4,600	Big bluestem	25
		Unfavorable	3,400	Indiangrass	10
				Switchgrass	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	5
				Other perennial grasses	20
Claremore part	Loamy prairie	Favorable	6,500	Little bluestem	25
		Normal	4,600	Big bluestem	25
		Unfavorable	3,400	Indiangrass	10
				Switchgrass	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	5
				Other perennial grasses	20
Collinsville: 19	Shallow prairie	Favorable	3,500	Little bluestem	25
		Normal	2,500	Big bluestem	15
		Unfavorable	1,800	Indiangrass	10
				Switchgrass	10
				Side-oats grama	10
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	5
				Other perennial grasses	15

TABLE 6.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
Crockett:					
20	Claypan prairie	Favorable	4,800	Big bluestem	25
		Normal	3,400	Little bluestem	20
		Unfavorable	2,400	Switchgrass	15
				Indiangrass	10
				Side-oats grama	5
				Scribner panicum	5
				Other perennial forbs	5
				Other perennial grasses	15
[1]21:					
Crockett part	Claypan prairie	Favorable	4,800	Big bluestem	25
		Normal	3,400	Little bluestem	20
		Unfavorable	2,400	Switchgrass	15
				Indiangrass	10
				Side-oats grama	5
				Scribner panicum	5
				Other perennial forbs	5
				Other perennial grasses	15
Durant part	Loamy prairie	Favorable	6,000	Little bluestem	25
		Normal	4,200	Big bluestem	15
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	5
				Side-oats grama	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	10
				Other perennial grasses	20
22	Eroded clay	Favorable	1,800	Side-oats grama	25
		Normal	1,200	Little bluestem	10
		Unfavoralbe	800	Hairy grama	10
				Texas grama	5
				Silver bluestem	5
				Tall dropseed	10
				Other perennial forbs	10
				Other perennial grasses	25
Dennis: 23, 24, 25	Loamy prairie	Favorable	7,000	Big bluestem	30
		Normal	5,500	Switchgrass	15
		Unfavorable	4,500	Little bluestem	10
				Indiangrass	10
				Scribner panicum	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	5
				Other perennial grasses	15
Durant:					
26, 27	Loamy prairie	Favorable	6,500	Little bluestem	25
		Normal	4,550	Big bluestem	20
		Unfavorable	3,250	Indiangrass	10
				Switchgrass	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	5
				Other perennial grasses	25
[1]28: Durant part	Loamy prairie	Favorable	6,000	Little bluestem	25
		Normal	4,200	Big bluestem	15
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	5
				Side-oats grama	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	10
				Other perennial grasses	20

TABLE 6.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
Eufaula: 29	Deep sand savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	15
		Unfavorable	2,000	Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Scribner panicum	5
				Perennial lespedezas	5
				Other trees	20
				Other perennial grasses	15
Ferris:					
30, 31	Blackclay prairie	Favorable	6,600	Little bluestem	30
		Normal	4,800	Indiangrass	15
		Unfavorable	3,600	Big bluestem	15
				Switchgrass	5
				Eastern gamagrass	5
				Virginia wildrye	5
				Side-oats grama	5
				Meadow dropseed	5
				Other perennial forbs	5
				Other perennial grasses	10
32:					
Ferris part	Blackclay prairie	Favorable	6,200	Little bluestem	35
		Normal	4,400	Indiangrass	10
		Unfavorable	3,200	Big bluestem	15
				Eastern gamagrass	5
				Virginia wildrye	5
				Side-oats grama	5
				Meadow dropseed	5
				Other perennial forbs	5
				Other perennial grasses	15
Romia part	Sandy savannah	Favorable	4,500	Indiangrass	10
		Normal	3,600	Little bluestem	20
		Unfavorable	2,800	Big bluestem	15
				Switchgrass	5
				Tall dropseed	5
				Scribner panicum	5
				Other perennial forbs	5
				Other perennial grasses	15
				Other trees	20
[1]33:					
Ferris part	Blackclay prairie	Favorable	6,200	Little bluestem	40
		Normal	4,400	Indiangrass	10
		Unfavorable	3,200	Big bluestem	10
				Eastern gamagrass	5
				Virginia wildrye	5
				Side-oats grama	5
				Meadow dropseed	5
				Other perennial forbs	5
				Other perennial grasses	15
Tarrant part	Very shallow	Favorable	2,500	Side-oats grama	15
		Normal	1,800	Silver bluestem	5
		Unfavorable	1,200	Little bluestem	15
				Hairy grama	5
				Buffalograss	5
				Texas grama	5
				Live oak	5
				Other perennial grasses	20
				Other shrubs	5
				Other perennial forbs	10
				Texas wintergrass	5
				Tall dropseed	5

TABLE 6.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
Fitzhugh:					
34	Loamy prairie	Favorable	7,000	Little bluestem	25
		Normal	5,000	Big bluestem	35
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	5
				Tall dropseed	5
				Other perennial grasses	10
				Other shrubs	5
				Other perennial forbs	5
[1]35:					
Fitzhugh part	Loamy prairie	Favorable	7,000	Little bluestem	25
		Normal	5,000	Big bluestem	35
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	5
				Tall dropseed	5
				Other perennial grasses	10
				Other shrubs	5
				Other perennial forbs	5
Bates part	Loamy prairie	Favorable	7,000	Big bluestem	35
		Normal	5,000	Little bluestem	25
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	5
				Tall dropseed	5
				Other shrubs	5
				Other perennial forbs	5
				Other perennial grasses	10
Freestone: 36	Loamy savannah	Favorable	5,800	Big bluestem	25
		Normal	4,100	Little bluestem	10
		Unfavorable	3,000	Indiangrass	15
				Beaked panicum	5
				Sedges	5
				Other perennial grasses	15
				Other perennial forbs	5
				Other shrubs	10
				Other trees	10
Heiden:					
40	Blackclay prairie	Favorable	7,000	Little bluestem	35
		Normal	5,200	Big bluestem	15
		Unfavorable	4,000	Indiangrass	10
				Eastern gamagrass	5
				Other perennial forbs	5
				Other perennial grasses	25
				Meadow dropseed	5
41	Blackclay prairie	Favorable	6,000	Little bluestem	25
		Normal	4,400	Big bluestem	10
		Unfavorable	3,200	Indiangrass	10
				Eastern gamagrass	5
				Side-oats grama	15
				Meadow dropseed	5
				Virginia wildrye	5
				Other perennial forbs	5
				Other perennial grasses	15
				Hairy grama	5
Karma:					
42, 43, 44	Loamy savannah	Favorable	5,500	Big bluestem	25
		Normal	3,800	Indiangrass	15
		Unfavorable	2,600	Little bluestem	10
				Switchgrass	5
				Beaked panicum	5
				Other trees	10
				Other perennial grasses	20
				Other perennial forbs	5
				Other shrubs	5

TABLE 6.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
Karma: continued					
45	Loamy savannah	Favorable	5,300	Big bluestem	20
		Normal	3,600	Indiangrass	15
		Unfavorable	2,500	Little bluestem	15
				Switchgrass	5
				Beaked panicum	5
				Other trees	15
				Other perennial grasses	15
				Other perennial forbs	5
				Other shrubs	5
Larue: 53	Sandy savannah	Favorable	5,000	Indiangrass	10
		Normal	3,800	Little bluestem	20
		Unfavorable	3,000	Big bluestem	15
				Switchgrass	5
				Tall dropseed	5
				Scribner panicum	5
				Other perennial forbs	5
				Other perennial grasses	15
				Other trees	20
Matoy: 55	Blackclay prairie	Favorable	6,500	Little bluestem	30
		Normal	4,700	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	5
				Eastern gamagrass	5
				Side-oats grama	5
				Meadow dropseed	5
				Other perennial grasses	20
				Other perennial forbs	5
Muskogee: 57, 58, 59, 60	Loamy savannah	Favorable	5,800	Big bluestem	25
		Normal	4,100	Little bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Beaked panicum	5
				Sedges	5
				Other perennial grasses	15
				Other perennial forbs	5
				Other shrubs	10
				Other trees	10
Okay: 62, 63, 64	Loamy prairie	Favorable	7,000	Big bluestem	35
		Normal	5,200	Indiangrass	15
		Unfavorable	4,000	Little bluestem	10
				Switchgrass	5
				Other perennial grasses	20
				Other trees	5
				Other shrubs	5
				Other perennial forbs	5
Parsons: 67	Claypan prairie	Favorable	4,500	Little bluestem	25
		Normal	3,000	Big bluestem	20
		Unfavorable	2,000	Switchgrass	15
				Indiangrass	10
				Side-oats grama	5
				Other perennial forbs	5
				Other perennial grasses	20
San Saba: [1]71:					
San Saba part	Blackclay prairie	Favorable	6,000	Little bluestem	30
		Normal	4,400	Big bluestem	10
		Unfavorable	3,200	Indiangrass	10
				Eastern gamagrass	5
				Side-oats grama	10
				Meadow dropseed	5
				Virginia wildrye	5
				Other perennial forbs	5
				Other perennial grasses	15
				Hairy grama	5

TABLE 6.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
San Saba: conitnued					
Tarrant part	Very shallow	Favorable	2,500	Little bluestem	15
		Normal	1,800	Side-oats grama	15
		Unfavorable	1,200	Buffalograss	5
				Hairy grama	5
				Texas wintergrass	5
				Texas grama	5
				Tall dropseed	5
				Silver bluestem	5
				Live oak	5
				Other perennial grasses	20
				Other perennial forbs	10
				Other shrubs	5
Tarrant: 75	Very shallow	Favorable	1,800	Little bluestem	10
		Normal	1,400	Side-oats grama	20
		Unfavorable	800	Hairy grama	10
				Texas grama	5
				Silver bluestem	15
				Live oak	5
				Other perennial grasses	15
				Other perennial forbs	10
				Other shrubs	10
Woodson: 79	Claypan prairie	Favorable	5,000	Big bluestem	25
		Normal	3,500	Little bluestem	20
		Unfavorable	2,500	Indiangrass	15
				Switchgrass	15
				Tall dropseed	5
				Other perennial forbs	5
				Other perennial grasses	15

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Woodland Management and Productivity[3]

Originally, about one-half of Bryan County was wooded. Now trees cover about one-fourth of the county. The value of the wood products is substantial, though it is below its potential. The wooded areas are also used for grazing, wildlife habitat, recreation, natural beauty, and conservation of soil and water. This section explains how soils affect tree growth and management in the county. In table 7, potential productivity and management problems of the soils are listed.

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Mapping unit symbols for those soils suitable for wood crops are listed, and the ordination symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the ordination symbol, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates no significant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the order in which the letters are listed—x, w, t, d, c, s, f, and r.

In table 7 the soils are also rated for a number of factors to be considered in management. The ratings of slight, moderate, and severe are used to indicate the degree of major soil limitations.

Ratings of the hazard of erosion indicate the risk of loss of soil in well-managed woodland. The risk is *slight* if the expected soil loss is small; *moderate* if some measures are needed to control erosion during logging and road construction; and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of equipment limitation reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of

[3]By NORMAN E. SMOLA, state woodland conservationist, Soil Conservation Service.

equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings when plant competition is not a limiting factor. The ratings are for seedlings from good planting stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate,* 25 to 50 percent; and *severe,* more than 50 percent.

Ratings of plant competition indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The potential productivity of merchantable trees on a soil is expressed as a site index. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands.

Trees to plant are those that are suitable for commercial wood or nut production and that are suited to the soils (fig. 10).

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants within the reach of livestock or of grazing or browsing wildlife. A well-managed wooded area can produce enough understory vegetation to support optimum numbers of livestock or wildlife, or both.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees, the density of the canopy, and the depth and condition of the forest litter. The density of the forest canopy is a major influence in that it affects the amount of light

Figure 10.—Pecan orchard on Karma fine sandy loam, 1 to 3 percent slopes.

TABLE 7.—*Woodland management and productivity*

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the inf

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity	
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index
Bernow: 2, 3, 4, 5, 6, 10	4o	Slight	Slight	Slight	Moderate	Southern red oak	60
[1]7:							
Bernow part	4o	Slight	Slight	Slight	Moderate	Southern red oak	60
Bosville part	4c	Slight	Moderate	Moderate	Moderate	Southern red oak Black oak	60 60
[1]8:							
Bernow part	4o	Slight	Slight	Severe	Moderate	Southern red oak	60
Romia part	4f	Slight	Slight	Severe	Moderate	Southern red oak Black oak	56
[1]9:							
Bernow part	4o	Slight	Slight	Severe	Moderate	Southern red oak	60
Romia part	4f	Moderate	Moderate	Severe	Moderate	Southern red oak Black oak	56
Bosville: 11, 12	4c	Slight	Moderate	Moderate	Moderate	Southern red oak Black oak	60 60
Boxville: 13, 14	4o	Slight	Slight	Slight	Moderate	Shortleaf pine Eastern redcedar Southern red oak	60 40
Durant: [1]28:							
Verdigris part	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood Hackberry Black walnut Silver maple Green ash Pecan	96
Ferris: [1]32:							
Romia part	4f	Moderate	Moderate	Severe	Moderate	Southern red oak Black oak	56
Freestone: 36	3w	Slight	Moderate	Slight	Moderate	Southern red oak	70
Frioton: 37	2o	Slight	Slight	Slight	Moderate	Southern red oak Hackberry Pecan	76
Gowton: 38	2o	Slight	Slight	Slight	Moderate	Southern red oak Hackberry Pecan	76
Guyton: 39	3w	Slight	Severe	Moderate	Moderate	Sweetgum Green ash Southern red oak Water oak	75

Karma: 42, 43, 44, 45	3o	Slight	Slight	Slight	Slight	Eastern cottonwood Pecan Green ash Black walnut	90
Kaufman: 46	2w	Slight	Moderate	Moderate	Moderate	Eastern cottonwood Sweetgum Water oak Pecan	100
47	3w	Slight	Severe	Moderate	Severe	Eastern cottonwood Sweetgum Water oak	90
Kiomatia: 48, 50	2o	Slight	Slight	Slight	Slight	Eastern cottonwood Sweetgum	100
49	3s	Moderate	Moderate	Severe	Moderate	Eastern cottonwood	90
Larton: 51, 52	3o	Slight	Slight	Slight	Slight	Southern red oak	70
Larue: 53	3s	Slight	Moderate	Moderate	Moderate	Southern red oak	70
Madill: 54	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood Pecan Green ash Black walnut	96
Muldrow: 56	2w	Slight	Moderate	Moderate	Moderate	Green ash Pecan Willow oak Water oak Hackberry	90
Muskogee: 57, 58, 59, 60	3o	Slight	Slight	Slight	Moderate	Sweetgum Water oak Southern red oak	80 70
Norwood: 61	2o	Slight	Slight	Slight	Slight	Eastern cottonwood	100
Oklared: 65, 66	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood Pecan Hackberry	100
Pledger: 69	3w	Slight	Severe	Moderate	Moderate	Pecan Eastern cottonwood Water oak Green ash	70 86 76
Redport: 70	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood Pecan Green ash Black walnut	96
Severn: 72	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood Pecan Hackberry Southern red oak	100 75

TABLE 7.—*Woodland management and productivity*—Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
Ships: 73, 74	3w	Slight	Severe	Moderate	Moderate	Eastern cottonwood Pecan Green ash	90	Eastern cottonwood, pecan, green ash.
Trinity: 76	3w	Slight	Severe	Moderate	Severe	Eastern cottonwood Green ash Pecan	86	Eastern cottonwood, green ash, pecan.
Tullahassee: 77	3w	Slight	Moderate	Moderate	Moderate	Eastern cottonwood American sycamore Sweetgum Water oak	90 85 80	Eastern cottonwood, American sycamore, sweetgum, water oak.
Verdigris: 78	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood Hackberry Black walnut Green ash	100	Eastern cottonwood, American sycamore, black walnut.
Woodtell: 80	4c	Slight	Moderate	Moderate	Moderate	Southern red oak Black oak	60	Shortleaf pine, loblolly pine.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

that understory plants receive during the growing season.

Table 8 shows, for each soil suitable for woodland, the potential for producing understory vegetation. The potential production of understory vegetation is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the soil moisture is above average during the optimum part of the growing season; in a normal year soil moisture is average; and in an unfavorable year it is below average.

Table 8 also lists the common names of the major native understory plants that grow on a specified soil and the percentage composition of each by air-dry weight. The kind and percentage of understory plants listed in the table are those to be expected where canopy density is most nearly typical of forests that yield the highest production of wood crops.

Wildlife Habitat[4]

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 9 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature study areas, and other developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.
3. Determining the intensity of management needed for each element of the habitat.
4. Determining areas that are suitable for acquisition to manage for wildlife.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means that re-

[4]By JEROME F. SYKORA, biologist, Soil Conservation Service.

TABLE 8.—*Woodland understory vegetation*

[Only the soils suitable for production of commercial trees are listed in this table]

Soil name and map symbol	Potential production		Common plant name	Composition
	Kind of year	Dry weight		
		Lb/acre		*Pct*
Bernow:				
2, 3, 4, 5, 6, 10	Favorable	2,100	Little bluestem	15
	Normal	1,500	Big bluestem	10
	Unfavorable	1,100	Yellow indiangrass	5
			Switchgrass	5
			Other shrubs	5
			Other trees	20
			Other perennial grasses	40
[17], [18], [19]:				
Bernow part	Favorable	2,100	Little bluestem	15
	Normal	1,500	Big bluestem	10
	Unfavorable	1,100	Switchgrass	5
			Yellow indiangrass	5
			Other shrubs	5
			Other trees	20
			Other perennial grasses	40
Bosville part	Favorable	2,300	Little bluestem	15
	Normal	1,700	Canada wildrye	10
	Unfavorable	1,300	Big bluestem	5
			Florida paspalum	5
			Broadleaf uniolas	5
			Perennial lespedezas	5
			Other hawthorns	5
			Other perennial grasses	20
			Other perennial forbs	10
			Other shrubs	10
			Other trees	10
Romia part	Favorable	2,000	Little bluestem	20
	Normal	1,400	Indiangrass	10
	Unfavorable	1,000	Other perennial forbs	5
			Other perennial grasses	35
			Other trees	15
			Other shrubs	15
Bosville: 11, 12	Favorable	2,300	Little bluestem	15
	Normal	1,700	Canada wildrye	10
	Unfavorable	1,300	Big bluestem	5
			Florida paspalum	5
			Broadleaf uniolas	5
			Perennial lespedezas	5
			Other hawthorns	5
			Other perennial grasses	20
			Other perennial forbs	10
			Other shrubs	10
			Other trees	10
Boxville: 13, 14	Favorable	2,200	Big bluestem	15
	Normal	1,600	Indiangrass	10
	Unfavorable	1,200	Little bluestem	10
			Switchgrass	5
			Beaked panicum	5
			Other trees	20
			Other perennial grasses	25
			Other perennial forbs	5
			Other shrubs	5
Ferris: 32:				
Romia part	Favorable	2,000	Little bluestem	20
	Normal	1,400	Indiangrass	10
	Unfavorable	1,000	Other perennial forbs	5
			Other perennial grasses	35
			Other trees	15
			Other shrubs	15

TABLE 8.—*Woodland understory vegetation*—Continued

Soil name and map symbol	Potential production		Common plant name	Composition
	Kind of year	Dry weight		
		Lb/acre		*Pct*
Freestone: 36	Favorable	2,500	Little bluestem	15
	Normal	1,750	Beaked panicum	10
	Unfavorable	1,000	Longleaf uniola	15
			Purpletop	5
			Panicum	10
			Other perennial forbs	5
			Other perennial grasses	20
			Other trees	10
			Other shrubs	5
			Sedges	5
Karma: 42, 43, 44, 45	Favorable	2,800	Big bluestem	25
	Normal	2,000	Indiangrass	15
	Unfavorable	1,500	Little bluestem	10
			Switchgrass	5
			Beaked panicum	5
			Other trees	20
			Other perennial grasses	10
			Other perennial forbs	5
			Other shrubs	5
Larton: 51, 52	Favorable	2,000	Little bluestem	15
	Normal	1,400	Panicum	10
	Unfavorable	1,000	Big bluestem	5
			Indiangrass	5
			Broadleaf uniolas	5
			Sedges	5
			Other perennial grasses	20
			Other perennial forbs	15
			Other shrubs	10
			Other trees	10
Larue: 53	Favorable	2,000	Little bluestem	15
	Normal	1,400	Panicum	10
	Unfavorable	1,000	Big bluestem	5
			Indiangrass	5
			Broadleaf uniolas	5
			Sedges	5
			Other perennial grasses	20
			Other perennial forbs	15
			Other trees	10
			Other shrubs	10
Muskogee: 57, 58, 59, 60	Favorable	2,500	Little bluestem	15
	Normal	1,750	Longleaf uniolas	15
	Unfavorable	1,000	Beaked panicum	5
			Purpletop	10
			Panicum	10
			Sedges	5
			Other trees	10
			Other perennial grasses	20
			Other perennial forbs	5
			Other shrubs	5
Woodtell: 80	Favorable	2,300	Little bluestem	15
	Normal	1,700	Canada wildrye	10
	Unfavorable	1,300	Big bluestem	5
			Florida paspalum	5
			Broadleaf uniolas	5
			Perennial lespedezas	5
			Other hawthorns	5
			Other perennial grasses	20
			Other perennial forbs	10
			Other shrubs	10
			Other trees	10

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9. *Wildlife habitat potentials*

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was

Soil name and map symbol	Potential for habitat elements								Poten	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wo wi
Bates: 1	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Bernow:										
2, 5, 10	Fair	Good	Good	Good	Good		Poor	Very poor	Good	Go
3, 4	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
6	Poor	Fair	Good	Good	Good		Poor	Very poor	Good	Go
[17]:										
Bernow part	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Bosville part	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
[18]:										
Bernow part	Fair	Good	Good	Good	Good		Poor	Very poor	Good	Go
Romia part	Poor	Fair	Good	Fair	Fair		Very poor	Very poor	Fair	Fa
[19]:										
Bernow part	Fair	Good	Good	Good	Good		Poor	Very poor	Good	Go
Romia part	Poor	Fair	Good	Fair	Fair		Very poor	Very poor	Fair	Fa
Bosville:										
11	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
12	Fair	Good	Good	Good	Good		Poor	Very poor	Good	Go
Boxville:										
13	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
14	Fair	Good	Good	Good	Good		Poor	Very poor	Good	Go
Burleson: 15, 16, 17	Good	Good	Poor			Poor	Very poor	Very poor	Fair	
Catoosa: [18]:										
Catoosa part	Fair	Good	Good	Good	Good		Poor	Very poor	Good	Go
Claremore part	Poor	Poor	Fair	Fair	Fair		Poor	Very poor	Poor	Fa
Collinsville: 19	Poor	Poor	Fair	Poor	Poor		Very poor	Very poor	Poor	Po
Crockett:										
20	Fair	Fair	Good	Poor	Poor		Poor	Very poor	Fair	Po
22	Poor	Fair	Good	Poor	Poor		Poor	Very poor	Fair	Po
[21]:										
Crockett part	Fair	Fair	Good	Poor	Poor		Poor	Very poor	Fair	Po
Durant part	Good	Good	Good			Fair	Poor	Very poor	Good	
Dennis:										
23, 24	Good	Good	Good	Good	Good		Poor	Poor	Good	Go
25	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Durant:										
26	Good	Good	Good			Fair	Poor	Poor	Good	
27	Good	Good	Good			Fair	Poor	Very poor	Good	
[28]:										
Durant part	Good	Good	Good			Fair	Poor	Very poor	Good	
Verdigris part	Poor	Fair	Fair	Good	Good	Good	Poor	Fair	Fair	Go

TABLE 9.—*Wildlife habitat potentials*—Continued

Soil name and map symbol	Potential for habitat elements								Poten	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wo wi
Eufaula: 29	Fair	Fair	Fair			Good	Very poor	Very poor	Fair	
Ferris:										
30	Fair	Good	Fair			Fair	Very poor	Very poor	Fair	
31	Poor	Fair	Fair			Fair	Very poor	Very poor	Fair	
[1]32:										
Ferris part	Poor	Fair	Fair			Fair	Very poor	Very poor	Fair	
Romia part	Poor	Fair	Good	Fair	Fair		Very poor	Very poor	Fair	Fa
[1]33:										
Ferris part	Poor	Fair	Fair			Fair	Very poor	Very poor	Fair	
Tarrant part	Very poor	Very poor	Fair		Poor	Fair	Very poor	Very poor	Poor	
Fitzhugh:										
34	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
[1]35:										
Fitzhugh part	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Bates part	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Freestone: 36	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Go
Frioton: 37	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Gowton: 38	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Guyton: 39	Fair	Fair	Fair	Fair	Fair		Good	Good	Fair	Fa
Heiden: 40, 41	Fair	Good	Fair			Fair	Poor	Very poor	Fair	
Karma:										
42, 43, 44	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
45	Fair	Good	Good	Good	Good		Poor	Very poor	Good	Go
Kaufman:										
46	Fair	Fair	Poor	Good	Good		Poor	Good	Fair	Go
47	Poor	Poor	Fair	Good	Good		Poor	Good	Poor	Go
Kiomatia: 48, [1]49, 50	Poor	Fair	Fair	Fair			Poor	Very poor	Fair	Fa
Larton: 51, 52	Fair	Fair	Good	Good	Good		Very poor	Very poor	Fair	Go
Larue: 53	Poor	Fair	Good	Good	Good		Poor	Very poor	Fair	Go
Madill: 54	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go
Matoy: 55	Fair	Good	Fair			Fair	Poor	Very poor	Fair	
Muldrow: 56	Fair	Good	Fair	Good	Good		Fair	Good	Fair	Go
Muskogee:										
57										
58	Good	Good	Good	Good	Good		Poor	Poor	Good	Go
59, 60	Good	Good	Good	Good	Good		Poor	Very poor	Good	Go

Norwood: 61	Good	Good	Fair	Good	Good		Poor	Very poor	Good	Goo
Okay: 62, 63, 64	Good	Good	Good	Good	Good		Poor	Very poor	Good	Goo
Oklared:										
65	Good	Good	Good	Good	Good		Poor	Very poor	Good	Goo
66	Good	Good	Fair	Good	Good		Poor	Very poor	Good	Goo
Parsons: 67	Fair	Good	Good	Good	Good		Fair	Fair	Good	Goo
Pits: 68	Very poor	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Fair
Pledger: 69	Fair	Fair	Fair	Good	Good	Good	Poor	Good	Fair	Goo
Redport: 70	Good	Good	Fair	Good	Good		Poor	Very poor	Good	Goo
San Saba: [1]71:										
San Saba part	Fair	Fair	Fair			Fair	Poor	Very poor	Fair	
Tarrant part	Very poor	Very poor	Fair		Poor	Fair	Very poor	Very poor	Poor	
Severn: 72	Good	Good	Good	Good	Good		Poor	Very poor	Good	Goo
Ships:										
73	Good	Good	Fair	Good	Good	Fair	Poor	Poor	Good	Fair
74	Very poor	Poor	Fair	Good	Good	Fair	Poor	Good	Poor	Fair
Tarrant: 75	Very poor	Very poor	Fair		Poor	Fair	Very poor	Very poor	Poor	
Trinity: 76	Fair	Good	Fair	Good	Good		Poor	Fair	Fair	Goo
Tullahassee: 77	Very poor	Poor	Poor	Good	Good		Fair	Poor	Poor	Fair
Verdigris: 78	Good	Good	Good	Good	Good	Good	Poor	Fair	Good	Goo
Woodson: 79	Good	Good	Poor			Good	Poor	Good	Fair	
Woodtell: 80	Good	Good	Good	Good	Good		Poor	Very poor	Good	Goo

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and beh
unit.

strictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, sorghum, wheat, oats, barley, millet, cowpeas, soybeans, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescue, lovegrass, switchgrass, bromegrass, clover, alfalfa, sericea, and crownvetch. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established herbaceous grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, indiangrass, euphorbias, goldenrod, beggarweed, maxmillian sunflower, pokeweed, partridgepea, annual sunflowers, and grama. Major soil properties that affect the growth of these plants are depth to the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also important.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, persimmon, sumac, hickory, black walnut, blackberry, grape, blackhaw, osageorange, bur oak, and hickory. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated good are Russian-olive, mulberry, autumn-olive, and crabapple. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

Coniferous plants are cone-bearing trees, shrubs, or ground cover that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Examples are pine and eastern red cedar. Major soil properties that affect the growth of coniferous plants are depth of the root zone, available water capacity, and wetness.

Shrubs are bushy woody plants that produce fruits, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are sumac, coralberry, skunkbrush, and green briar. Major soil properties that affect the growth of shrubs are depth of root zone, available water capacity, salinity, and moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, wild millet, rushes, sedges, reeds, saltgrass, and cattail. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness.

Shallow water areas are bodies of surface water that have an average depth of less than 5 feet and are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control devices in marshes or streams. Examples are waterfowl feeding areas, wildlife watering developments, and other wildlife ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of croplands, pastures, meadows, and areas that are composed of a combination of grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite, quail, dove, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of hardwoods or conifers or a mixture of both, with associated grasses, legumes, and wild herbaceous plants. Examples of wildlife attracted to this habitat are wild turkey, woodcock, thrushes, woodpeckers, tree squirrels, grey fox, raccoon, and deer.

Wetland habitat consists of water-tolerant plants in open, marshy, or swampy shallow water areas. Examples of wildlife attracted to this habitat are ducks, geese, herons, shore birds, rails, muskrat, mink, and beaver.

Rangeland habitat consists of wild herbaceous plants and shrubs on range. Examples of wildlife attracted to this habitat are white-tailed deer, quail, dove, and meadowlark.

Engineering[5]

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in tables in this section are based on test data and estimated data in the section "Soil Properties." The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

[5]By WILLIAM E. HARDESTY, civil engineer, and JESSE L. MCMASTERS, area engineer, Soil Conservation Service.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 or 6 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to—(1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 10 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 11, for sanitary facilities; and table 13, for water management. Table 12 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have different meanings in soil science and in engineering; the Glossary defines many of these terms.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 10. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 10 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation do not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 10 have an all-weather surface that can carry light to medium

TABLE 10.—*Building site development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Bates: 1	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell, low strength.
Bernow:					
2, 4, 5, 10	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.
3	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
6	Moderate: slope	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell, low strength, wetness.	Severe: slope	Moderate: low strength, slope, shrink-swell.
[1]7:					
Bernow part	Slight	Moderate: shrink-swell.	Moderate: low strength, wetness, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Bosville part	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: low strength, wetness, shrink-swell.	Severe: low strength, shrink-swell.
[1]8:					
Bernow part	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.
Romia part	Moderate: small stones.	Slight	Slight	Moderate: slope	Moderate: low strength.
[1]9:					
Bernow part	Moderate: slope	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope	Moderate: low strength, shrink-swell, slope.
Romia part	Moderate: small stones, slope.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: low strength, slope.
Bosville: 11, 12	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: low strength, wetness, shrink-swell.	Severe: low strength, shrink-swell.
Boxville:					
13	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
14	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength.
Burleson: 15, 16, 17	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Catoosa: [1]18:					
Catoosa part	Severe: depth to rock.	Moderate: low strength, depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: low strength, depth to rock, shrink-swell.	Severe: low strength.
Claremore part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Collinsville: 19	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Crockett:					
20, 22	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]21:					
Crockett part	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Durant part	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Dennis: 23, 24, 25	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.

TABLE 10.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Durant: 26, 27	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]28: Durant part	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strentgh.	Severe: shrink-swell, low strength.
Verdigris part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Eufaula: 29	Severe: cutbanks cave.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
Ferris: 30, 31	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
[1]32: Ferris part	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Romia part	Moderate: small stones, slope.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: low strength, slope.
[1]33: Ferris part	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Tarrant part	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
Fitzhugh: 34	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope	Moderate: low strength.
[1]35: Fitzhugh part	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: low strength.
Bates part	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.
Freestone: 36	Severe: wetness, too clayey.	Moderate: shrink-swell, low strength.	Severe: wetness, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Frioton: 37	Severe: floods	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Gowton: 38	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, low strength.
Guyton: 39	Severe: floods, wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, corrosive.	Severe: floods, wetness.
Heiden: 40, 41	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Karma: 42	Slight	Slight	Slight	Slight	Moderate: low strength.
43, 44	Slight	Slight	Slight	Moderate: slope	Moderate: low strength.
45	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: low strength, slope.
Kaufman: 46, 47	Severe: too clayey, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Kiomatia: 48, [1]49, 50	Severe: floods, too sandy.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.

TABLE 10.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Larton:					
51	Slight	Slight	Slight	Slight	Moderate: low strength.
52	Slight	Slight	Slight	Moderate: slope	Moderate: low strength.
Larue: 53	Slight	Slight	Slight	Slight	Slight.
Madill: 54	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, low strength.
Matoy: 55	Severe: depth to rock, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Muldrow: 56	Severe: wetness, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.
Muskogee: 57, 58, 59, 60	Severe: too clayey	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Norwood: 61	Moderate: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: low strength, floods.
Okay: 62, 63, 64	Slight	Slight	Slight	Slight	Moderate: low strength.
Oklared: 65, 66	Moderate: wetness	Severe: floods	Severe: floods	Severe: floods	Moderate: low strength, floods.
Parsons: 67	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: low strength, shrink-swell.
Pits: 68.					
Pledger: 69	Severe: too clayey, wetness, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: low strength, shrink-swell.
Redport: 70	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, low strength, shrink-swell.
San Saba: [1]71:					
San Saba part	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, depth to rock, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Tarrant part	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
Severn: 72	Moderate: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: low strength, floods.
Ships: 73, 74	Severe: too clayey	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: shrink-swell, low strength.
Tarrant: 75	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
Trinity: 76	Severe: wetness, floods, too clayey.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: shrink-swell, floods.
Tullahassee: 77	Severe: wetness, floods.	Severe: floods	Severe: wetness, floods.	Severe: floods	Severe: floods.

TABLE 10.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Verdigris: 78	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Moderate: floods, shrink-swell, low strength.
Woodson: 79	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.
Woodtell: 80	Severe: wetness, too clayey.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones, all of which affect stability and ease of excavation, were also considered.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 11 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight,* soils are favorable for the specified use and limitations are minor and easily overcome; if *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe,* soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and a shallow depth to bedrock interfere with installation. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that are very high in organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage

TABLE 11.—*Sanitary facilities*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Bates: 1	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
Bernow:					
2, 3, 4, 5, 10	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
6	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
[1]7:					
Bernow part	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Bosville part	Severe: percs slowly, wetness.	Severe: wetness	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
[1]8:					
Bernow part	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Romia part	Moderate: percs slowly, depth to rock.	Moderate: seepage, slope, depth to rock.	Moderate: depth to rock.	Slight	Fair: small stones.
9:					
Bernow part	Moderate: slope	Severe: slope	Slight	Moderate: slope	Fair: slope.
Romia part	Moderate: percs slowly, depth to rock, slope.	Severe: slope	Moderate: depth to rock.	Moderate: slope	Fair: small stones.
Bosville: 11, 12	Severe: percs slowly, wetness.	Severe: wetness	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
Boxville: 13, 14	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
Burleson:					
15	Severe: percs slowly.	Slight	Severe: too clayey	Slight	Poor: too clayey.
16, 17	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
Catoosa: [1]18:					
Catoosa part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer, area reclaim.
Claremore part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
Collinsville: 19	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: seepage, depth to rock.	Severe: seepage	Poor: thin layer, area reclaim.
Crockett:					
20, 22	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
[1]21:					
Crockett part	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
Durant part	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
Dennis:					
23	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
24, 25	Severe: percs slowly, wetness.	Moderate: slope	Severe: too clayey	Severe: wetness	Poor: too clayey.
Durant:					
26, 27	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
[1]28:					
Durant part	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
Verdigris part	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Fair: too clayey.
Eufaula: 29	Moderate: slope	Severe: seepage	Severe: seepage	Severe: seepage	Poor: too sandy.

TABLE 11.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ferris:					
30	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
31	Severe: percs slowly.	Severe: slope	Severe: too clayey	Moderate: slope	Poor: too clayey.
[1]32:					
Ferris part	Severe: percs slowly.	Severe: slope	Severe: too clayey	Moderate: slope	Poor: too clayey.
Romia part	Moderate: percs slowly, depth to rock, slope.	Severe: slope	Moderate: depth to rock.	Moderate: slope	Fair: small stones.
[1]33:					
Ferris part	Severe: percs slowly.	Severe: slope	Severe: too clayey	Moderate: slope	Poor: too clayey.
Tarrant part	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope	Poor: thin layer, large stones, too clayey.
Fitzhugh:					
34	Moderate: depth to rock.	Moderate: slope, depth to rock, seepage.	Moderate: depth to rock.	Slight	Good.
[1]35:					
Fitzhugh part	Moderate: depth to rock.	Moderate: slope, depth to rock, seepage.	Moderate: depth to rock.	Slight	Good.
Bates part	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
Freestone: 36	Severe: percs slowly, wetness.	Severe: wetness	Severe: too clayey, wetness.	Severe: wetness	Fair: too clayey.
Frioton: 37	Severe: percs slowly, floods.	Severe: floods	Severe: floods	Severe: floods	Poor: too clayey.
Gowton: 38	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Good.
Guyton: 39	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Heiden: 40, 41	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Poor: too clayey.
Karma:					
42, 43, 44	Slight	Severe: seepage	Severe: seepage	Slight	Good.
45	Moderate: slope	Severe: seepage, slope.	Severe: seepage	Moderate: slope	Fair: slope.
Kaufman: 46, 47	Severe: percs slowly, floods, wetness.	Severe: floods	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
Kiomatia:					
48, [1]49	Moderate: floods	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
50	Severe: floods	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
Larton: 51, 52	Slight	Moderate: seepage, slope.	Slight	Slight	Fair: too sandy.
Larue: 53	Slight	Moderate: seepage	Moderate: seepage	Slight	Fair: too sandy.
Madill: 54	Severe: floods	Severe: seepage, floods.	Severe: seepage, floods.	Severe: floods, seepage.	Good.
Matoy: 55	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey, area reclaim.
Muldrow: 56	Severe: percs slowly, wetness.	Severe: wetness	Severe: wetness, too clayey.	Severe: wetness	Poor: too clayey.

TABLE 11.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Muskogee:					
57	Severe: percs slowly.	Slight	Severe: too clayey	Slight	Fair: too clayey.
58, 59, 60	Severe: percs slowly.	Moderate: slope	Severe: too clayey	Slight	Fair: too clayey.
Norwood: 61	Moderate: floods	Moderate: seepage	Moderate: floods	Moderate: floods	Good.
Okay: 62, 63, 64	Slight	Severe: seepage	Severe: seepage	Slight	Good.
Oklared: 65, 66	Severe: wetness	Severe: wetness, seepage.	Severe: seepage	Severe: seepage	Good.
Parsons: 67	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
Pits: 68.					
Pledger: 69	Severe: percs slowly, wetness.	Severe: floods, wetness.	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
Redport: 70	Moderate: floods	Moderate: seepage	Moderate: floods, too clayey.	Moderate: floods	Fair: too clayey.
San Saba: [1]71:					
San Saba part	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
Tarrant part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, large stones, too clayey.
Severn: 72	Moderate: floods	Severe: seepage	Severe: seepage	Severe: seepage	Good.
Ships:					
73	Severe: percs slowly.	Slight	Severe: too clayey	Moderate: floods	Poor: too clayey.
74	Severe: percs slowly, floods.	Severe: floods	Severe: floods, too clayey.	Severe: floods, wetness.	Poor: too clayey.
Tarrant: 75	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, large stones, too clayey.
Trinity: 76	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey.
Tullahassee: 77	Severe: floods, wetness.	Severe: wetness, floods, seepage.	Severe: floods, wetness, seepage.	Severe: wetness, floods, seepage.	Good.
Verdigris: 78	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Fair: too clayey.
Woodson: 79	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.
Woodtell: 80	Severe: percs slowly, wetness.	Severe: wetness	Severe: too clayey, wetness.	Severe: wetness	Poor: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste, either in excavated trenches or on the surface of the soil. The waste is spread, compacted in layers, and covered with thin layers of soil. Landfill areas are subject to heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches.

Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 11 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and stone content do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for landfills should be soil that is easy to excavate and spread over the compacted fill during both wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the site should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 12 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet, and described as the survey is made.

Roadfill is soil material used in embankments for roads. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 15 provide more specific information about the nature of each horizon that can help determine its suitability for roadfill.

Soils rated *good* have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, high potential frost action, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor,* regardless of the quality of the suitable material.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones, are low in content of gravel and other coarse fragments, and have gentle slopes. They are low in soluble salts, which can limit plant growth. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils, very firm clayey soils, soils with suitable layers less than 8 inches thick, soils having large amounts of gravel, stones or soluble salt, steep soils, and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is much preferred for topsoil because of its organic matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

TABLE 12.—*Construction materials*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Bates: 1	Poor: thin layer	Unsuited: excess fines	Unsuited: excess fines	Good.
Bernow:				
2, 3, 4, 5, 6, 10	Fair: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
[17]:				
Bernow part	Fair: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
Bosville part	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
[18]:				
Bernow part	Fair: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
Romia part	Fair: low strength	Poor: excess fines	Poor: excess fines	Poor: too sandy, small stones.
[19]:				
Bernow part	Fair: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: slope, thin layer.
Romia part	Fair: low strength	Poor: excess fines	Poor: excess fines	Poor: too sandy, small stones.
Bosville: 11, 12	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Boxville: 13, 14	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
Burleson: 15, 16, 17	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Catoosa: [118]:				
Catoosa part	Poor: low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, area reclaim.
Claremore part	Poor: thin layer, area reclaim	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, area reclaim.
Collinsville: 19	Poor: thin layer, area reclaim	Unsuited: excess fines	Unsuited: excess fines	Poor: thin layer, area reclaim.
Crockett:				
20, 22	Poor: low strength, shrink-swell	Unsuited: low strength	Unsuited: low strength	Poor: thin layer.
[121]:				
Crockett part	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: thin layer.
Durant part	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, too clayey.
Dennis: 23, 24, 25	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
Durant:				
26, 27	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, too clayey.
[128]:				
Durant part	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, too clayey.
Verdigris part	Fair: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
Eufaula: 29	Good	Poor: excess fines	Unsuited: excess fines	Poor: too sandy.
Ferris:				
30, 31	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
[132]:				
Ferris part	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Romia part	Fair: low strength	Poor: excess fines	Poor: excess fines	Poor: too sandy, small stones.
[133]:				
Ferris part	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Tarrant part	Poor: thin layer, large stones	Unsuited: excess fines	Unsuited: excess fines	Poor: thin layer, large stones.
Fitzhugh:				
34	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
[135]:				
Fitzhugh part	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
Bates part	Poor: thin layer	Unsuited: excess fines	Unsuited: excess fines	Good.
Freestone: 36	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.

TABLE 12.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Frioton: 37	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey, thin layer.
Gowton: 38	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
Guyton: 39	Poor: wetness	Unsuited: excess fines	Unsuited: excess fines	Poor: wetness.
Heiden: 40, 41	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Karma:				
42, 43, 44	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
45	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, slope.
Kaufman: 46, 47	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Kiomatia: 48, [1]49, 50	Good	Poor: excess fines	Unsuited: excess fines	Poor: too sandy.
Larton: 51, 52	Fair: low strength	Poor: excess fines	Unsuited: excess fines	Poor: too sandy.
Larue: 53	Good	Poor: excess fines	Unsuited: excess fines	Poor: too sandy.
Madill: 54	Fair: low strength	Poor: excess fines	Unsuited: excess fines	Good.
Matoy: 55	Poor: shrink-swell, low strength, area reclaim.	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, too clayey.
Muldrow: 56	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
Muskogee: 57, 58, 59, 60.	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer, too clayey.
Norwood: 61	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
Okay: 62, 63, 64	Good	Unsuited: excess fines	Unsuited: excess fines	Fair: thin layer.
Oklared:				
65	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
66	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
Parsons: 67	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
Pits: 68.				
Pledger: 69	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Redport: 70	Fair: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
San Saba: [1]71:				
San Saba part	Poor: shrink-swell, area reclaim, low strength.	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey, area reclaim.
Tarrant part	Poor: thin layer, large stones	Unsuited: excess fines	Unsuited: excess fines	Poor: thin layer, large stones.
Severn: 72	Fair: low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
Ships: 73, 74	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Tarrant: 75	Poor: thin layer, large stones	Unsuited: excess fines	Unsuited: excess fines	Poor: thin layer, large stones.
Trinity: 76	Poor: low strength, shrink-swell	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.
Tullahassee: 77	Fair: wetness, low strength	Unsuited: excess fines	Unsuited: excess fines	Good.
Verdigris: 78	Fair: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
Woodson: 79	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Fair: too clayey.
Woodtell: 80	Poor: shrink-swell, low strength	Unsuited: excess fines	Unsuited: excess fines	Poor: too clayey.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 13 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitation are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the rated use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability, texture, structure, depth to claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation, and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff at nonerosive velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Irrigation

Irrigation can be made profitable by installing an efficient system that supplements local rainfall. The feasibility of irrigation is determined mainly by the nature of the soil and the quality and quantity of water available.

To be suitable for irrigation, a soil must be (1) productive, (2) capable of storing enough water for plants, (3) nearly level to gently sloping, (4) permeable enough to prevent accumulation of salts, and (5) deep enough to allow necessary leveling and to provide an adequate root zone. Soils in capability classes I and II, which are described in the section "Capability Grouping," are well suited to irrigation, but irrigation is less successful on strongly sloping soils.

The main sources of water for irrigation are reservoirs, underground water in alluvial material along major streams, and underground water in upland areas where the quantity is sufficient. The most common source is reservoirs.

Wells are needed to tap a source of underground water. The depth to the underground water level ranges from only a few feet near the streams in the county to about 200 to 400 feet in upland areas. The quality of the underground water generally is good. The quantity that can be obtained from a single well ranges from 50 to 800 gallons per minute. Each well should be subjected to a 24- to 48-hour pumping test, which will determine the drawdown, the pumping lift, and the capacity of the well. Information on drawdown, lift, and well capacity is essential for the selection of an efficient pumping plant and for the design of a suitable irrigation system.

A surface irrigation system is suitable for some soils in this county, and a sprinkler system for others. The selection of a system depends on the lay of the land, the cost of leveling, the kinds of crops to be grown, and other factors. The main types of surface irrigation used in the county are border and furrow.

A border system is suited to loamy soils that have slopes of less than 3 percent. For efficient use of water, a border system requires land leveling, a fairly large stream of water, corrugations on clayey soils, short runs on fine sandy loams, and close-growing crops on soils that have slopes of more than 1 percent.

A furrow system is suitable for all soils that have slopes of less than 5 percent. Small amounts of water can be distributed evenly by this system, and row crops can be irrigated easily. The limitations of a furrow system are the need for short runs on fine sandy loams, the complicated layouts on rolling land, the maintenance requirements, and the difficulty of harvesting crops.

A sprinkler system is suitable for nearly level to sloping, loamy soils. The advantages of such a system are that land leveling, ditches, or surface drainage systems are not required and equipment can be moved from field to field. The disadvantages are the high cost of installation and maintenance, the difficulty of moving a portable system in cultivated fields, the risk of increased fungus growth, and the failure of some crops to bear fruit if the blossoms are sprinkled. Sprinkler irrigation is not suitable for clayey soils, which take in water slowly.

All crops commonly grown in the county can be

TABLE 13.—*Water management*

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Bates: 1	Moderate: depth to rock, seepage.	Moderate: thin layer.	Not needed	Erodes easily, rooting depth.	Erodes easily, depth to rock.	Rooting depth, erodes easily.
Bernow:						
2, 3, 4, 5	Moderate: seepage	Slight	Not needed	Erodes easily, slope.	Erodes easily	Erodes easily.
6, 10	Moderate: seepage	Slight	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
[1]7:						
Bernow part	Moderate: seepage	Slight	Not needed	Erodes easily	Erodes easily	Erodes easily.
Bosville part	Slight	Moderate: unstable fill, compressible, shrink-swell.	Percs slowly, slope, wetness.	Slow intake	Percs slowly	Percs slowly.
[1]8:						
Bernow part	Moderate: seepage	Slight	Not needed	Erodes easily, slope.	Erodes easily	Erodes easily.
Romia part	Moderate: seepage, depth to rock.	Moderate: thin layer, unstable fill.	Not needed	Erodes easily, slope.	Erodes easily	Erodes easily.
[1]9:						
Bernow part	Moderate: seepage	Slight	Not needed	Erodes easily, slope.	Slope, erodes easily.	Slope, erodes easily.
Romia part	Moderate: seepage, depth to rock.	Moderate: thin layer, unstable fill.	Not needed	Slope, erodes easily.	Erodes easily, slope.	Slope, erodes easily.
Bosville: 11, 12	Slight	Moderate: unstable fill, compressible, shrink-swell.	Percs slowly, slope, wetness.	Slow intake, slope.	Percs slowly	Percs slowly.
Boxville: 13, 14	Slight	Moderate: unstable fill, compressible, shrink-swell.	Not needed	Slow intake, slope.	Percs slowly	Percs slowly.
Burleson: 15, 16, 17	Slight	Moderate: unstable fill, hard to pack, shrink-swell.	Percs slowly	Slow intake	Percs slowly	Percs slowly.
Catoosa: [1]18:						
Catoosa part	Severe: depth to rock.	Moderate: unstable fill, piping, thin layer.	Not needed	Rooting depth, erodes easily.	Depth to rock, erodes easily.	Rooting depth, erodes easily.
Claremore part	Severe: depth to rock.	Severe: thin layer, area reclaim.	Not needed	Rooting depth, droughty.	Depth to rock, droughty.	Rooting depth, droughty.
Collinsville: 19	Severe: seepage, depth to rock.	Severe: thin layer, area reclaim.	Not needed	Rooting depth, droughty, slope.	Depth to rock, droughty, slope.	Depth to rock, droughty, slope.
Crockett:						
20, 22	Slight	Moderate: compressible, unstable fill, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.
[1]21:						
Crockett part	Slight	Moderate: compressible, unstable fill, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.
Durant part	Slight	Severe: unstable fill, compressible, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.
Dennis: 23, 24, 25	Slight	Moderate: unstable fill, compressible, shrink-swell.	Percs slowly, wetness.	Slow intake	Percs slowly	Percs slowly.
Durant:						
26, 27	Slight	Severe: unstable fill, compressible, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.

TABLE 13.—*Water management*—Continued

Soil name and map symbol	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Durant: continued						
[1]28:						
Durant part	Slight	Severe: unstable fill, compressible, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.
Verdigris part	Moderate: seepage	Moderate: piping, unstable fill.	Floods	Floods	Floods	Floods.
Eufaula: 29	Severe: seepage	Moderate: unstable fill, seepage.	Not needed	Slope, fast intake, droughty.	Seepage, fast intake, droughty.	Erodes easily, droughty, fast intake.
Ferris:						
30, 31	Slight	Moderate: unstable fill, hard to pack, shrink-swell.	Not needed	Slope, slow intake.	Percs slowly, slope.	Percs slowly, slope.
[1]32:						
Ferris part	Slight	Moderate: unstable fill, hard to pack, shrink-swell.	Not needed	Slope, slow intake.	Percs slowly, slope.	Percs slowly, slope.
Romia part	Moderate: seepage, depth to rock.	Moderate: thin layer, unstable fill.	Not needed	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
[1]33:						
Ferris part	Slight	Moderate: unstable fill, hard to pack, shrink-swell.	Not needed	Slope, slow intake.	Percs slowly, slope.	Percs slowly, slope.
Tarrant part	Severe: depth to rock.	Severe: thin layer, large stones, area reclaim.	Depth to rock	Rooting depth, droughty, slope.	Depth to rock, large stones, droughty.	Rooting depth, large stones, droughty.
Fitzhugh:						
34	Moderate: seepage, depth to rock.	Moderate: unstable fill.	Not needed	Erodes easily	Erodes easily	Erodes easily.
[1]35:						
Fitzhugh part	Moderate: seepage, depth to rock.	Moderate: unstable fill.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Bates part	Moderate: depth to rock, seepage.	Moderate: thin layer.	Not needed	Rooting depth, erodes easily.	Depth to rock, erodes easily.	Erodes easily, rooting depth.
Freestone: 36	Slight	Moderate: unstable fill, compressible, shrink-swell.	Percs slowly, wetness.	Slow intake	Percs slowly	Percs slowly.
Frioton: 37	Moderate: seepage	Moderate: unstable fill, compressible, shrink-swell.	Floods, percs slowly.	Floods, slow intake.	Floods, percs slowly.	Floods, percs slowly.
Gowton: 38	Moderate: seepage	Moderate: unstable fill.	Not needed	Floods	Floods	Floods.
Guyton: 39	Slight	Moderate: unstable fill, low strength, compressible.	Cutbanks cave	Slow intake	Floods	Wetness.
Heiden: 40, 41	Slight	Moderate: unstable fill, shrink-swell, hard to pack.	Not needed	Slow intake	Percs slowly	Percs slowly.
Karma: 42, 43, 44, 45.	Severe: seepage	Moderate: unstable fill.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Kaufman: 46, 47	Slight	Moderate: unstable fill, hard to pack, shrink-swell.	Floods, wetness, percs slowly.	Slow intake, floods, wetness.	Wetness, floods, percs slowly.	Percs slowly, wetness, floods.

TABLE 13.—*Water management*—Continued

Soil name and map symbol	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Kiomatia: 48, [1]49	Severe: seepage	Severe: unstable fill, seepage.	Not needed	Fast intake, floods.	Seepage, floods	Floods, seepage.
50	Severe: seepage	Severe: unstable fill, seepage.	Not needed	Floods, fast intake.	Seepage, floods	Floods, seepage.
Larton: 51, 52	Moderate: seepage	Moderate: unstable fill.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Larue: 53	Moderate: seepage	Moderate: unstable fill.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Madill: 54	Severe: seepage	Moderate: unstable fill, seepage.	Not needed	Floods, fast intake.	Seepage, floods	Seepage, floods.
Matoy: 55	Severe: depth to rock.	Moderate: unstable fill, thin layer, shrink-swell.	Not needed	Rooting depth, slow intake.	Depth to rock, percs slowly.	Percs slowly, depth to rock.
Muldrow: 56	Slight	Severe: compressible, shrink-swell.	Percs slowly, floods, wetness.	Slow intake, floods, wetness.	Percs slowly, wetness, floods.	Percs slowly, wetness, floods.
Muskogee:						
57	Slight	Moderate: compressible, unstable fill.	Not needed	Slow intake	Percs slowly	Percs slowly.
58, 59, 60	Slight	Moderate: compressible, unstable fill.	Not needed	Slow intake	Percs slowly	Percs slowly.
Norwood: 61	Moderate: seepage	Moderate: piping, unstable fill.	Not needed	Favorable	Floods	Floods.
Okay:						
62, 63	Severe: seepage	Moderate: unstable fill.	Not needed	Favorable	Erodes easily	Erodes easily.
64	Severe: seepage	Moderate: unstable fill.	Not needed	Erodes easily	Erodes easily	Erodes easily.
Oklared: 65, 66	Severe: seepage	Moderate: unstable fill, seepage.	Not needed	Favorable	Floods, seepage	Floods.
Parsons: 67	Slight	Moderate: unstable fill, compressible, shrink-swell.	Percs slowly, wetness.	Slow intake, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
Pits: 68.						
Pledger: 69	Slight	Moderate: unstable fill, hard to pack, shrink-swell.	Percs slowly, wetness, floods.	Slow intake, wetness, floods.	Percs slowly, wetness, floods.	Percs slowly, wetness, floods.
Redport: 70	Moderate: seepage	Moderate: unstable fill, piping.	Not needed	Favorable	Floods	Floods.
San Saba: [1]71:						
San Saba part	Severe: depth to rock.	Moderate: unstable fill, thin layer, shrink-swell.	Not needed	Slow intake, rooting depth, slope.	Percs slowly, depth to rock.	Percs slowly, depth to rock.
Tarrant part	Severe: depth to rock.	Severe: thin layer, large stones, area reclaim.	Not needed	Rooting depth, droughty, slope.	Depth to rock, large stones, droughty.	Rooting depth, large stones, droughty.
Severn: 72	Severe: seepage	Moderate: unstable fill, piping.	Not needed	Favorable	Floods	Floods.
Ships: 73, 74	Slight	Moderate: unstable fill, hard to pack, shrink-swell.	Percs slowly	Slow intake	Percs slowly, floods.	Percs slowly, floods.

TABLE 13.—*Water management*—Continued

Soil name and map symbol	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Tarrant: 75	Severe: depth to rock.	Severe: thin layer, large stones, area reclaim.	Not needed	Rooting depth, droughty, slope.	Depth to rock, large stones, droughty.	Rooting depth, large stones, droughty.
Trinity: 76	Slight	Moderate: shrink-swell, unstable fill, hard to pack.	Percs slowly, floods, wetness.	Slow intake, wetness, floods.	Wetness, floods, percs slowly.	Wetness, floods, percs slowly.
Tullahassee: 77	Severe: seepage	Moderate: unstable fill, seepage.	Floods	Floods	Floods	Floods.
Verdigris: 78	Moderate: seepage	Moderate: piping, unstable fill.	Not needed	Floods	Floods	Floods.
Woodson: 79	Slight	Moderate: shrink-swell, unstable fill, hard to pack.	Wetness, percs slowly.	Slow intake, wetness.	Wetness, percs slowly.	Percs slowly, wetness.
Woodtell: 80	Slight	Moderate: unstable fill, shrink-swell, compressible.	Percs slowly	Slow intake	Percs slowly	Percs slowly.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

Figure 11.—Picnic and camping area on Karma fine sandy loam, 1 to 3 percent slopes.

grown under irrigation, but irrigated soils need intensive management for control of erosion and maintenance of productivity. Field crops, nurseries, orchards, truck crops, and grass can also be irrigated.

Recreation

The soils of the survey area are rated in table 14 according to limitations that affect their suitability for camp areas, picnic areas (fig. 11), playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration of flooding and the season when it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 14 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 14 can be supplemented by additional information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 11, and interpretations for dwellings without basements and for local roads and streets, given in table 10.

Camp areas require such site preparation as shaping and leveling tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet nor subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and not wet nor subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

The design and layout of paths and trails for walking, horseback riding, and bicycling should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Soil Properties

Extensive data about soil properties collected during the soil survey are summarized on the following pages. The two main sources of these data are the many soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist can identify several important properties. He notes the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in-place under the existing soil moisture conditions. He records the root depth of existing plants, determines soil pH or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each horizon of each soil in the survey area. Also, pertinent soil and water features, engineering test data, and data obtained from laboratory analyses, both physical and chemical, are presented.

Engineering Properties and Classification

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a

TABLE 14.—*Recreational development*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Bates: 1	Slight	Slight	Moderate: slope	Slight.
Bernow:				
2	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy, slope.	Moderate: too sandy.
3, 4	Slight	Slight	Moderate: slope	Slight.
5, 10	Slight	Slight	Severe: slope	Slight.
6	Moderate: slope	Moderate: slope	Severe: slope	Slight.
[1]7:				
Bernow part	Slight	Slight	Moderate: slope	Slight.
Bosville part	Severe: percs slowly, wetness.	Moderate: wetness	Severe: percs slowly	Slight.
[1]8:				
Bernow part	Slight	Slight	Moderate: slope	Slight.
Romia part	Moderate: small stones, too sandy.	Moderate: too sandy, small stones.	Severe: too sandy, small stones.	Moderate: small stones, too sandy.
[1]9:				
Bernow part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Romia part	Moderate: small stones, too sandy, slope.	Moderate: too sandy, slope, small stones.	Severe: too sandy, small stones, slope.	Moderate: small stones, too sandy.
Bosville:				
11	Severe: percs slowly, wetness.	Moderate: wetness	Severe: percs slowly	Slight.
12	Severe: percs slowly, wetness.	Moderate: wetness	Severe: percs slowly, slope.	Slight.
Boxville:				
13	Moderate: percs slowly	Slight	Moderate: percs slowly, slope.	Slight.
14	Moderate: percs slowly	Slight	Severe: slope	Slight.
Burleson: 15, 16, 17	Severe: percs slowly, too clayey.	Severe: too clayey	Severe: percs slowly, too clayey.	Severe: too clayey.
Catoosa: [1]18:				
Catoosa part	Slight	Slight	Moderate: depth to rock, slope.	Slight.
Claremore part	Slight	Slight	Severe: depth to rock	Slight.
Collinsville: 19	Slight	Slight	Severe: depth to rock, slope.	Slight.
Crockett:				
20, 22	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
[1]21:				
Crockett part	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
Durant part	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
Dennis:				
23	Moderate: wetness, percs slowly.	Slight	Moderate: percs slowly, wetness.	Slight.
24, 25	Moderate: wetness, percs slowly.	Slight	Moderate: percs slowly, slope, wetness.	Slight.
Durant:				
26, 27	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
[1]28:				
Durant part	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
Verdigris part	Severe: floods	Severe: floods	Severe: floods	Moderate: too clayey.
Eufaula: 29	Moderate: too sandy	Moderate: too sandy	Severe: too sandy	Severe: too sandy.
Ferris:				
30	Severe: too clayey, percs slowly.	Severe: too clayey	Severe: too clayey, percs slowly.	Severe: too clayey.
31	Severe: too clayey, percs slowly.	Severe: too clayey	Severe: too clayey, percs slowly, slope.	Severe: too clayey.

TABLE 14.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ferris: continued				
[1]32:				
Ferris part	Severe: too clayey, percs slowly.	Severe: too clayey	Severe: too clayey, percs slowly, slope.	Severe: too clayey.
Romia part	Moderate: small stones, too sandy, slope.	Moderate: too sandy, slope, small stones.	Severe: too sandy, small stones, slope.	Moderate: small stones, too sandy.
[1]33:				
Ferris part	Severe: too clayey, percs slowly.	Severe: too clayey	Severe: too clayey, percs slowly, slope.	Severe: too clayey.
Tarrant part	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, slope, too clayey.	Severe: large stones, too clayey.
Fitzhugh:				
34	Slight	Slight	Moderate: slope	Slight.
[1]35:				
Fitzhugh part	Slight	Slight	Moderate: slope	Slight.
Bates part	Slight	Slight	Moderate: slope	Slight.
Freestone: 36	Moderate: percs slowly, wetness.	Moderate: wetness	Moderate: percs slowly, wetness.	Slight.
Frioton: 37	Severe: floods	Moderate: too clayey, floods.	Moderate: floods, too clayey, percs slowly.	Moderate: too clayey, floods.
Gowton: 38	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Guyton: 39	Severe: wetness, floods	Severe: wetness	Severe: wetness	Severe: wetness.
Heiden: 40, 41	Severe: too clayey, percs slowly.	Severe: too clayey	Severe: too clayey, percs slowly.	Severe: too clayey.
Karma:				
42	Slight	Slight	Slight	Slight.
43, 44	Slight	Slight	Moderate: slope	Slight.
45	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Kaufman: 46, 47	Severe: wetness, too clayey, floods.	Severe: too clayey	Severe: wetness, too clayey, floods.	Severe: too clayey.
Kiomatia:				
[1]49, 50	Severe: too sandy, floods.	Severe: too sandy, floods.	Severe: too sandy, floods.	Severe: too sandy, floods.
48	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
Larton: 51, 52	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy, slope.	Moderate: too sandy.
Larue: 53	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
Madill: 54	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Matoy: 55	Moderate: too clayey, percs slowly.	Moderate: too clayey	Moderate: percs slowly, too clayey, depth to rock.	Moderate: too clayey.
Muldrow: 56	Severe: wetness, percs slowly, floods.	Moderate: wetness, too clayey, floods.	Severe: wetness, percs slowly.	Moderate: too clayey, wetness.
Muskogee:				
57	Moderate: percs slowly	Slight	Moderate: percs slowly	Slight.
58, 59, 60	Moderate: percs slowly	Slight	Moderate: slope, percs slowly.	Slight.
Norwood: 61	Severe: floods	Slight	Slight	Slight.
Okay:				
62, 63	Slight	Slight	Slight	Slight.
64	Slight	Slight	Moderate: slope	Slight.
Oklared:				
65	Severe: floods	Slight	Slight	Slight.
66	Severe: floods	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.

TABLE 14.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Parsons: 67	Severe: wetness, percs slowly.	Moderate: wetness	Severe: wetness, percs slowly.	Moderate: wetness.
Pits: 68.				
Pledger: 69	Severe: percs slowly, too clayey, wetness.	Severe: too clayey	Severe: percs slowly, too clayey, wetness.	Severe: too clayey.
Redport: 70	Severe: floods	Moderate: too clayey, floods.	Moderate: too clayey, floods.	Moderate: too clayey.
San Saba: [1]71:				
San Saba part	Severe: percs slowly, too clayey.	Severe: too clayey	Severe: percs slowly, too clayey.	Severe: too clayey.
Tarrant part	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, large stones, too clayey.	Severe: large stones, too clayey.
Severn: 72	Severe: floods	Moderate: floods	Slight	Slight.
Ships: 73, 74	Severe: percs slowly, floods, too clayey.	Severe: too clayey	Severe: percs slowly too clayey.	Severe: too clayey.
Tarrant: 75	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, large stones, too clayey.	Severe: large stones, too clayey.
Trinity: 76	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.	Severe: percs slowly, too clayey, wetness.	Severe: too clayey, wetness.
Tullahassee: 77	Severe: floods	Severe: floods	Severe: floods	Moderate: wetness, floods.
Verdigris: 78	Severe: floods	Moderate: too clayey, floods.	Moderate: too clayey, floods.	Moderate: too clayey.
Woodson: 79	Severe: percs slowly	Moderate: wetness	Severe: percs slowly	Moderate: wetness.
Woodtell: 80	Severe: percs slowly	Slight	Severe: percs slowly	Slight.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in the section "Description of the Soils."

Texture is described in table 15 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified soil classification system[6] and the American Association of State Highway and Transportation Officials soil classification system (AASHTO).[7] In Table 15 soils in the survey area are classified according to both systems.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified as A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2,

[6]American Society for Testing and Materials. 1974 method for classification of soils for engineering purposes. ASTM Stand. D 2487-69 *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp. illus.

[7]American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 v., illus.

TABLE 15.—*Engineering properties and classifications*

[The symbol < means less than; > means greater than. Absence of an entry means data were not estim

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number–			
			Unified	AASHTO		4	10	40	
	In				*Pct*				
Bates: 1	0–11	Fine sandy loam	ML, SM	A–4	0	100	100	90–100	4
	11–28	Loam, clay loam, sandy clay loam.	ML, CL	A–4, A–6	0	100	100	90–100	5
	28–33	Unweathered bedrock.							
Bernow:									
2	0–15	Loamy fine sand	ML, SM, CL–ML, SM–SC	A–4	0	100	95–100	90–100	4
	15–38	Loam, sandy clay loam, clay loam.	CL	A–6	0	100	100	90–100	5
	38–68	Sandy clay loam, clay loam.	CL, SC	A–4, A–6	0	100	95–100	90–100	4
3, 4, 5, 6, 10	0–15	Fine sandy loam	ML, SM, CL–ML, SM–SC	A–4	0	100	95–100	90–100	4
	15–38	Loam, sandy clay loam, clay loam.	CL	A–6	0	100	100	90–100	5
	38–68	Sandy clay loam, clay loam.	CL, SC	A–4, A–6	0	96–100	96–100	90–100	3
27:									
Bernow part	0–15	Fine sandy loam	ML, SM, CL–ML, SM–SC	A–4	0	100	95–100	90–100	4
	15–38	Loam, sandy clay loam, clay loam.	CL	A–6	0	100	100	90–100	5
	38–68	Sandy clay loam, clay loam.	CL, SC	A–4, A–6	0	100	95–100	90–100	4
Bosville part	0–4	Fine sandy loam	SM, ML, CL, SC	A–4	0	100	98–100	94–100	3
	4–70	Silty clay loam, silty clay, clay.	CL, CH	A–6, A–7	0	100	100	96–100	8
28:									
Bernow part	0–15	Loamy fine sand	ML, SM, CL–ML, SM–SC	A–4	0	100	95–100	90–100	4
	15–38	Loam, sandy clay loam, clay loam.	CL	A–6	0	100	100	90–100	5
	38–68	Sandy clay loam, clay loam.	CL, SC	A–4, A–6	0	100	95–100	90–100	4
Romia part	0–18	Loamy fine sand	SM, SP–SM	A–2, A–3	2–25	80–98	75–98	70–95	
	18–47	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A–2, A–4, A–6	0	75–100	65–100	60–95	2
	47–56	Weathered bedrock			0				
29:									
Bernow part	0–15	Loamy fine sand	ML, SM, CL–ML, SM–SC	A–4	0	100	95–100	90–100	4
	15–38	Loam, sandy clay loam, clay loam.	CL	A–6	0	100	100	90–100	5
	38–68	Loam, sandy clay loam	CL, SC	A–4, A–6	0	100	95–100	90–100	4

TABLE 15.—*Engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments >3 inches	Percentage passing sieve number-			
			Unified	AASHTO		4	10	40	
	In				*Pct*				
Bernow: [2]9:									
Romia part	30–18	Cobbly loamy fine sand	SM, SP–SM	A–2, A–3	2–25	80–98	75–98	70–95	
	18–47	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A–2, A–4, A–6	0	75–100	65–100	60–95	2
	47–56	Weathered bedrock.			0				
Bosville: 11, 12	0–4	Fine sandy loam	SM, ML, CL, SC	A–4	0	100	98–100	94–100	3
	4–70	Silty clay loam, silty clay, clay.	CL, CH	A–6, A–7	0	100	100	96–100	8
Boxville: 13, 14	0–8	Fine sandy loam	SM, ML, SC, CL	A–4	0	100	98–100	94–100	3
	8–57	Silty clay loam, clay, silty clay.	CL, CH	A–6, A–7	0	100	100	96–100	8
	57–70	Clay loam, clay shaly silty clay.	CL, CH	A–6, A–7	0	100	100	96–100	8
Burleson: 15, 16, 17.	0–60	Clay	CH, MH	A–7–6, A–7–5	0–1	95–100	80–100	75–95	7
Catoosa: [2]18:									
Catoosa part	0–8	Silt loam	ML, CL	A–4, A–6	0	100	100	96–100	6
	8–12	Silt loam, silty clay loam.	ML, CL	A–4, A–6, A–7	0	100	100	96–100	6
	12–22	Silty clay loam, clay loam.	CL	A–6, A–7	0	100	100	96–100	8
	22–26	Unweathered bedrock.							
Claremore part	0–8	Silt loam	ML, CL	A–4, A–6	0	98–100	95–100	90–100	6
	8–11	Silty clay loam, silt loam	CL	A–4, A–6	0	98–100	95–100	90–100	8
	11–18	Silty clay loam, clay loam.	CL	A–6, A–7	0	98–100	95–100	90–100	8
	18–24	Unweathered bedrock.							
Collinsville: 19	0–12	Fine sandy loam, loam	SM, SC, ML, CL	A–4	0–3	80–100	60–100	60–95	3
	12–14	Unweathered bedrock.							
Crockett:									
20, 22	0–7	Loam	CL–ML, CL	A–4	0	100	100	96–100	6
	7–52	Silty clay, clay	CL, CH	A–7	0	100	100	95–100	9
	52–64	Clay	CL, CH	A–7	0	90–100	90–100	75–100	5
[2]21:									
Crockett part	0–7	Loam	CL–ML, CL	A–4	0	100	100	96–100	6
	7–52	Silty clay, clay	CL, CH	A–7	0	100	100	95–100	9
	52–64	Clay	CL, CH	A–7	0	100	100	95–100	9
Durant part	0–8	Loam	CL, ML	A–4, A–6	0	100	100	96–100	6
	8–11	Clay loam, silty clay loam, clay.	CL, CH, MH, ML	A–6, A–7	0	100	100	96–100	8
	11–64	Clay	CL, CH, MH, ML	A–7	0	100	100	96–100	9
Dennis: 23, 24, 25.	0–11	Loam	ML, CL	A–4, A–6	0	100	100	96–100	6
	11–15	Silty clay loam, clay loam.	CL	A–6, A–7	0	98–100	98–100	94–100	7
	15–65	Clay, silty clay loam, clay loam.	CL, CH, ML, MH	A–7, A–6	0	98–100	98–100	94–100	7

Durant:									
26, 27	0–8	Loam	CL, ML	A–4, A–6	0	100	100	96–100	6
	8–11	Clay loam, silty clay loam, clay.	CL, CH, MH, ML	A–6, A–7	0	100	100	96–100	8
	11–64	Clay	CL, CH, MH, ML	A–7	0	100	100	96–100	9
[2]28:									
Durant part	0–8	Silt loam	CL, ML	A–4, A–6	0	100	100	96–100	6
	8–11	Clay loam, silty clay loam, clay.	CL, CH, MH, ML	A–6, A–7	0	100	100	96–100	8
	11–64	Clay	CL, CH, MH, ML	A–7	0	100	100	96–100	9
Verdigris part	0–24	Silty clay loam, silt loam.	ML, CL	A–4, A–6, A–7	0	100	100	96–100	6
	24–60	Silt loam, silty clay loam.	ML, CL	A–4, A–6, A–7	0	100	100	96–100	8
Eufaula: 29	0–80	Fine sand, loamy fine sand.	SM, SP–SM	A–2, A–3	0	100	98–100	82–100	
Ferris:									
30, 31	0–60	Clay	CH	A–7–6	0	95–100	95–100	75–100	7
[2]32									
Ferris part	0–60	Clay	CH	A–7–6	0	95–100	95–100	75–100	7
Romia part	0–18	Loamy fine sand	SM, SP–SM	A–2, A–3	0	100	98–100	82–100	
	18–47	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A–2, A–4, A–6	0	75–100	65–100	60–95	2
	47–56	Weathered bedrock.			0				
[2]33:									
Ferris part	0–60	Clay	CH	A–7–6	0	95–100	95–100	75–100	7
Tarrant part	0–16	Cobbly silty clay, stony silty clay, clay.	CH, GC	A–7–6	33–77	55–100	51–100	51–95	4
	16–30	Indurated, unweathered bedrock.							
Fitzhugh: 34	0–11	Fine sandy loam	SM, ML, SC, CL	A–4, A–6	0	100	98–100	94–100	3
	11–51	Loam, clay loam	CL, ML	A–4, A–6	0	100	100	90–100	3
	51–60	Weathered bedrock.							
[2]35:									
Fitzhugh part	0–11	Fine sandy loam, loam	SM, ML, SC, CL	A–4	0	100	98–100	94–100	3
	11–51	Loam, clay loam	CL, ML	A–4, A–6	0	100	100	90–100	3
	51–60	Weathered bedrock.							
Bates part	0–11	Fine sandy loam	CL–ML, SM–SC	A–4	0	100	98–100	94–100	3
	11–28	Loam, clay loam, sandy clay loam.	CL	A–4, A–6	0	100	100	96–100	6
	28–33	Unweathered bedrock.							
Freestone: 36	0–14	Fine sandy loam	SM, SC, CL, ML	A–4	0	95–100	95–100	90–100	3
	14–42	Sandy clay loam, loam, clay loam.	CL	A–6, A–7	0	95–100	95–100	90–100	5
	42–64	Sandy clay loam, clay, clay loam.	CL, CH	A–6, A–7	0	100	100	90–100	5
Frioton: 37	0–62	Silty clay loam, silty clay, gravelly silty clay loam.	CL, CH	A–6, A–7	0	100	100	98–100	9
Gowton: 38	0–31	Loam, clay loam	ML, CL	A–4, A–6	0	100	100	96–100	6
	31–60	Loam, clay loam	ML, CL	A–4, A–6	0	100	100	96–100	6

TABLE 15—*Engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number—			
			Unified	AASHTO		4	10	40	
	In				*Pct*				
Guyton: 39	0–17	Silt loam	ML, CL–ML	A–4	0	100	100	95–100	6
	17–42	Clay loam, silty clay loam.	CL, CL–ML	A–6, A–4	0	100	100	95–100	7
	42–65	Silt loam, silty clay loam, clay loam.	CL, CL–ML, ML	A–6, A–4	0	100	100	95–100	6
Heiden: 40, 41	0–8	Clay	CH	A–7–6	0	95–100	90–100	80–100	7
	8–62	Clay, shaly clay	CH	A–7–6	0	90–100	90–100	75–100	7
Karma: 42, 43, 44, 45	0–11	Fine sandy loam	ML, CL, SM, SC	A–4	0	100	98–100	94–100	3
	11–52	Sandy clay loam, clay loam.	CL, SC	A–4, A–6	0	100	100	90–100	3
	52–65	Fine sandy loam, loam, sandy clay loam.	ML, CL, SM, SC	A–4, A–6	0	100	98–100	90–100	3
Kaufman: 46, 47	0–8	Clay	CH	A–7	0	100	100	96–100	9
	8–62	Clay	CH	A–7	0	100	100	96–100	9
Kiomatia: 48, [2]49	0–4	Fine sandy loam, silty clay loam.	SM, SM–SC	A–4, A–2–4	0	100	95–100	80–100	3
	4–60	Stratified fine sand to loamy fine sand.	SM, SM–SC	A–2–4	0	100	95–100	80–90	1
50	0–4	Very fine sandy loam, loamy fine sand, fine sandy loam.	SM, SM–SC	A–4, A–2	0	100	95–100	80–100	3
	4–60	Stratified fine sand to loamy fine sand.	SM, SM–SC	A–2–4	0	100	95–100	80–90	1
Larton: 51, 52	0–25	Loamy fine sand	SM	A–2	0	100	98–100	99–100	1
	25–60	Fine sandy loam, loam	SM, ML, SC	A–4	0	100	98–100	94–100	3
	60–73	Sandy clay loam	CL, SC	A–4, A–6	0	100	100	90–100	3
Larue: 53	0–26	Loamy fine sand	SM	A–2	0	100	98–100	90–100	1
	26–60	Sandy clay loam, loam, clay loam.	SC, CL	A–4, A–6	0	100	100	90–100	3
	60–74	Sandy clay loam, loam, clay loam.	SC, CL	A–4, A–6	0	100	95–100	90–100	3
Madill: 54	0–16	Fine sandy loam	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	16–30	Fine sandy loam, loam	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	30–68	Fine sandy loam, loam	SM, SC, ML, CL	A–4	0	100	98–100	90–100	3
Matoy: 55	0–10	Silty clay loam	CL	A–6, A–7	0	100	100	95–100	8
	10–31	Silty clay loam, silty clay, clay.	CL, CH	A–7	0	98–100	95–100	95–100	9
	31–38	Silty clay loam, silty clay, clay.	CL, CH	A–7	0	70–98	70–95	65–95	6
	38–40	Unweathered bedrock.							
Muldrow: 56	0–10	Silty clay loam	CL	A–6, A–7	0	100	100	96–100	8
	10–64	Silty clay loam, silty clay, clay.	CL, CH, ML, MH	A–6, A–7	0	100	100	96–100	8
Muskogee: 57, 58, 59, 60.	0–26	Silt loam, silty clay loam	ML, CL	A–4, A–6	0	100	100	95–100	8
	26–42	Silty clay loam	CL	A–6, A–7	0	100	100	95–100	9
	42–62	Silty clay	CH, CL	A–7	0	100	100	98–100	9

Norwood: 61	0–27	Silty clay loam, silt loam	CL, ML	A–4, A–6, A–7	0	100	100	95–100	80
	27–60	Silt loam, silty clay loam, loam.	CL, ML	A–6, A–4, A–7	0	100	100	96–100	7
Okay: 62, 63, 64	0–17	Fine sandy loam, loam	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	17–55	Clay loam, loam, sandy clay loam.	SC, CL, ML, SM	A–4, A–6	0	100	100	90–100	3
	55–68	Sandy clay loam, fine sandy loam.	SM, SC, ML, CL	A–4, A–6	0	100	98–100	90–100	3
Oklared:									
65	0–7	Fine sandy loam	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	7–24	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	24–60	Fine sandy loam, very fine sandy loam, loamy fine sand.	SM, SC, ML, CL	A–2, A–4	0	100	98–100	90–100	1
66	0–7	Silty clay loam	CL	A–6, A–7	0	100	100	98–100	9
	7–24	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	24–60	Fine sandy loam, very fine sandy loam, loamy fine sand.	SM, SC, ML, CL	A–2, A–4	0	100	98–100	90–100	1
Parsons: 67	0–14	Silt loam	ML, CL–ML	A–4	0	100	100	96–100	8
	14–62	Clay loam, silty clay loam, silty clay, clay.	CL, CH	A–6, A–7	0	100	100	96–100	8
Pits: 68.									
Pledger: 69	0–8	Clay	CH	A–7	0	100	100	96–100	9
	8–76	Clay	CH	A–7	0	100	100	96–100	9
Redport: 70	0–74	Silty clay loam, silt loam, clay loam.	ML, CL	A–4, A–6, A–7	0	100	100	96–100	8
San Saba: [2]71:									
San Saba part	0–26	Clay	CH	A–7	0	100	98–100	95–100	9
	26–30	Unweathered bedrock.							
Tarrant part	0–16	Cobbly silty clay, stony silty clay, clay.	CH, MH	A–7	25–60	60–90	60–90	60–90	5
	16–20	Indurated, unweathered bedrock.							
Severn: 72	0–10	Fine sandy loam	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	10–74	Very fine sandy loam, loamy very fine sand, silt loam, loam.	ML, CL	A–4	0	100	100	94–100	5
Ships: 73, 74	0–73	Clay	CH	A–7	0	100	100	95–100	9
Tarrant: 75	0–16	Cobbly silty clay, stony silty clay, clay.	CH, MH	A–7	25–60	60–90	60–90	60–90	5
	16–20	Indurated, unweathered bedrock.							
Trinity: 76	0–10	Clay	CH	A–7	0	100	98–100	96–100	9
	10–60	Clay, silty clay	CH	A–7	0	100	98–100	96–100	9
Tullahassee: 77	0–14	Fine sandy loam	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3
	14–60	Fine sandy loam, sandy loam.	SM, SC, ML, CL	A–4	0	100	98–100	94–100	3

TABLE 15.—*Engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments >3 inches	Percentage passing sieve number— 4	10	40	200	Liquid limit	Plasticity index
	In				*Pct*					*Pct*	
Verdigris: 78	0–24	Silty clay loam, silt loam.	ML, CL	A-4, A-6, A-7	0	100	100	96–100	80–98	30–42	8–19
	24–60	Silt loam, silty clay loam, clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	96–100	80–98	30–42	8–19
Woodson: 79	0–9	Silt loam	ML, CL-ML	A-4	0	100	100	96–100	80–97	22–30	2–7
	9–50	Clay	CH	A-7	0	100	100	96–100	90–95	50–65	30–45
	50–60	Clay	CH	A-7	0	100	100	96–100	90–95		
Woodtell: 80	0–6	Loam	ML, CL-ML	A-4	0	100	100	96–100	65–85	23–29	3–7
	6–41	Clay, clay loam, silty clay loam.	CL, CH	A-7	0	100	100	96–100	80–95	42–60	19–38
	41–63	Clay	CL, CH	A-7	0	100	100	96–100	90–95	45–60	19–38

[1]NP means nonplastic.
[2]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

and A-7 groups are further classified as follows: A-1-a, A-1-b; A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 18. The estimated classification, without group index numbers, is given in table 15. Also in table 15 the percentage, by weight, of cobbles or the rock fragments more than 3 inches in diameter are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These indexes are used in both the Unified and the AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and Chemical Properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture — that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the planning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

TABLE 16.—*Physical and chemical properties of soils*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (
Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion	
							Uncoated steel	Concrete
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*			
Bates: 1	0–11	0.6–2.0	0.15–0.17	5.1–6.0	<2	Low	Low	Moderate
	11–28	0.6–2.0	0.15–0.19	5.1–6.5	<2	Moderate	Low	Moderate
	28–33							
Bernow:								
2, 3, 4, 5, 6, 10	0–15	2.0–6.0	0.11–0.15	5.6–6.5	<2	Low	Moderate	Moderate
	15–38	0.6–2.0	0.12–0.20	4.5–6.0	<2	Moderate	Moderate	Moderate
	38–68	0.6–2.0	0.12–0.20	4.5–6.0	<2	Low	Moderate	Moderate
[17]:								
Bernow part	0–15	2.0–6.0	0.11–0.15	5.6–6.0	<2	Low	Moderate	Moderate
	15–38	0.6–2.0	0.12–0.20	4.5–5.5	<2	Moderate	Moderate	Moderate
	38–68	0.6–2.0	0.12–0.20	4.5–6.0	<2	Low	Moderate	Moderate
Bosville part	0–4	0.6–2.0	0.11–0.15	5.1–6.0	<2	Low	Moderate	Moderate
	4–70	<0.06	0.10–0.15	4.5–6.0	<2	High	High	High
[18]:								
Bernow part	0–15	2.0–6.0	0.11–0.15	5.6–6.0	<2	Low	Moderate	Moderate
	15–38	0.6–2.0	0.12–0.20	4.5–5.5	<2	Moderate	Moderate	Moderate
	38–68	0.6–2.0	0.12–0.20	4.5–6.0	<2	Low	Moderate	Moderate
Romia part	0–18	2.0–6.0	0.03–0.08	5.1–6.5	<2	Low	Low	Moderate
	18–47	0.6–2.0	0.08–0.18	4.5–6.0	<2	Low	High	High
	47–56							
[19]:								
Bernow part	0–15	2.0–6.0	0.11–0.15	5.6–6.5	<2	Low	Moderate	Moderate
	15–38	0.6–2.0	0.12–0.20	4.5–6.0	<2	Moderate	Moderate	Moderate
	38–68	0.6–2.0	0.12–0.20	4.5–5.5	<2	Low	Moderate	Moderate
Romia part	0–18	2.0–6.0	0.03–0.08	5.1–6.5	<2	Low	Low	Moderate
	18–47	0.6–2.0	0.08–0.18	4.5–6.0	<2	Low	High	High
	47–56							
Bosville: 11, 12	0–4	0.6–2.0	0.11–0.15	5.1–6.0	<2	Low	Moderate	Moderate
	4–70	<0.06	0.10–0.15	4.5–6.0	<2	High	High	High
Boxville: 13, 14	0–8	2.0–6.0	0.11–0.20	5.1–6.5	<2	Low	Low	High
	8–57	0.06–0.2	0.10–0.15	4.5–8.4	<2	High	High	High
	57–70	0.06–0.2	0.10–0.15	5.6–8.4	<2	High	High	High
Burleson: 15, 16, 17	0–60	<0.06	0.10–0.15	6.1–8.4	<2	High	High	Low
Catoosa: [18]:								
Catoosa part	0–8	0.6–2.0	0.15–0.24	5.6–6.5	<2	Low	Low	Moderate
	8–12	0.6–2.0	0.15–0.24	5.6–6.5	<2	Moderate	Moderate	Moderate
	12–22	0.6–2.0	0.15–0.22	5.6–7.3	<2	Moderate	Moderate	Moderate
	22–26							
Claremore part	0–8	0.6–2.0	0.16–0.24	5.6–6.5	<2	Low	Moderate	Moderate
	8–11	0.6–2.0	0.16–0.22	5.6–6.5	<2	Moderate	Moderate	Moderate
	11–18	0.6–2.0	0.16–0.20	5.6–7.3	<2	Moderate	Moderate	Moderate
	18–20							
Collinsville: 19	0–12	2.0–6.0	0.09–0.16	5.1–6.5	<2	Low	Low	Moderate
	12–14							

TABLE 16.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion	
							Uncoated steel	Concrete
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*			
Crockett:								
20, 22	0–7	0.6–2.0	0.11–0.15	5.6–7.3	<2	Low	High	Low
	7–52	<0.06	0.10–0.15	5.6–7.9	<2	High	High	Low
	52–64	0.06–0.2	0.10–0.15	7.9–8.4	<2	Moderate	High	Low
[1]21:								
Crockett part	0–7	0.6–2.0	0.11–0.15	5.6–7.3	<2	Low	High	Low
	7–52	<0.06	0.10–0.15	5.6–7.9	<2	High	High	Low
	52–64	0.06–0.2	0.10–0.15	7.9–8.4	<2	Moderate	High	Low
Durant part	0–8	0.6–2.0	0.15–0.24	5.6–6.5	<2	Low	High	Moderate
	8–11	<0.06	0.12–0.22	5.6–6.5	<2	Moderate	High	Moderate
	11–64	<0.06	0.12–0.18	5.6–8.4	<2	High	High	Moderate
Dennis: 23, 24, 25	0–11	0.6–2.0	0.15–0.20	5.1–6.0	<2	Low	Low	Moderate
	11–15	0.2–0.6	0.15–0.20	5.1–6.0	<2	Moderate	Moderate	Moderate
	15–65	0.06–0.2	0.15–0.20	5.1–7.9	<2	High	High	Moderate
Durant:								
26, 27	0–8	0.6–2.0	0.15–0.24	5.6–6.5	<2	Low	High	Moderate
	8–11	<0.06	0.12–0.22	5.6–6.5	<2	Moderate	High	Moderate
	11–64	<0.06	0.12–0.18	5.6–8.4	<2	High	High	Moderate
[1]28:								
Durant part	0–8	0.6–2.0	0.15–0.24	5.6–6.5	<2	Low	High	Moderate
	8–11	<0.06	0.12–0.22	5.6–6.5	<2	Moderate	High	Moderate
	11–64	<0.06	0.12–0.18	5.6–8.4	<2	High	High	Moderate
Verdigris part	0–24	0.6–2.0	0.22–0.24	5.6–7.3	<2	Moderate	Low	Low
	24–60	0.6–2.0	0.17–0.22	5.6–7.3	<2	Moderate	Low	Low
Eufaula: 29	0–80	6.0–20.0	0.05–0.11	5.6–6.5	<2	Low	Low	Moderate
Ferris:								
30, 31	0–60	<0.06	0.10–0.15	7.9–8.4	<2	Very high	High	Low
[1]32:								
Ferris part	0–60	<0.06	0.10–0.15	7.9–8.4	<2	Very high	High	Low
Romia part	0–18	2.0–6.0	0.05–0.11	5.1–6.5	<2	Low	Low	Moderate
	18–47	0.6–2.0	0.08–0.18	4.5–6.0	<2	Low	High	High
	47–56							
[1]33:								
Ferris part	0–60	<0.06	0.10–0.15	7.9–8.4	<2	Very high	High	Low
Tarrant part	0–16	0.2–0.6	0.10–0.17	7.9–8.4	<2	High	High	Low
	16–20							
Fitzhugh:								
34	0–11	2.0–6.0	0.11–0.20	5.6–6.5	<2	Low	Low	Moderate
	11–51	0.6–2.0	0.12–0.20	5.1–6.5	<2	Low	Moderate	Moderate
	51–60							
[1]35:								
Fitzhugh part	0–11	2.0–6.0	0.11–0.20	5.6–6.5	<2	Low	Low	Moderate
	11–51	0.6–2.0	0.12–0.20	5.1–6.5	<2	Low	Moderate	Moderate
	51–60							
Bates part	0–11	0.6–2.0	0.15–0.17	5.1–6.0	<2	Low	Low	Moderate
	11–28	0.6–2.0	0.15–0.19	5.1–6.5	<2	Moderate	Low	Moderate
	28–33							

Freestone: 36	0–14	2.0–6.0	0.11–0.15	5.6–7.3	<2	Low	Moderate	Low
	14–42	0.2–0.6	0.12–0.17	5.1–7.3	<2	Moderate	High	Moderate
	42–64	0.06–0.2	0.12–0.18	6.1–7.8	<2	High	High	Moderate
Frioton: 37	0–62	0.2–0.6	0.18–0.22	7.4–8.4	<2	High	High	Low
Gowton: 38	0–31	0.6–2.0	0.15–0.20	5.6–7.8	<2	Low	Moderate	Moderate
	31–60	0.6–2.0	0.15–0.20	6.1–8.4	<2	Low	Moderate	Moderate
Guyton: 39	0–17	0.6–2.0	0.20–0.23	4.5–5.5	<2	Low	High	Moderate
	17–42	0.06–0.2	0.15–0.22	4.5–6.0	<2	Low	High	Moderate
	42–65	0.06–2.0	0.15–0.22	5.6–8.4	<2	Low	High	Low
Heiden: 40, 41	0–8	<0.06	0.15–0.20	7.4–8.4	<2	Very high	High	Low
	8–62	<0.06	0.10–0.15	7.9–8.4	<2	Very high	High	Low
Karma: 42, 43, 44, 45	0–11	0.6–2.0	0.11–0.20	5.6–7.8	<2	Low	Low	Moderate
	11–52	0.6–2.0	0.12–0.20	5.6–7.8	<2	Low	Low	Moderate
	52–65	0.6–6.0	0.11–0.20	5.6–7.8	<2	Low	Low	Moderate
Kaufman: 46, 47	0–8	0.06–0.2	0.10–0.15	5.6–7.8	<2	High	High	Low
	8–62	<0.06	0.10–0.15	5.6–7.8	<2	Very high	High	Low
Kiomatia: 48, [1]49, 50	0–4	0.6–2.0	0.10–0.15	7.9–8.4	<2	Low	Low	Low
	4–60	6.0–20	0.05–0.10	7.9–8.4	<2	Low	Low	Low
Larton: 51, 52	0–25	2.0–6.0	0.07–0.11	5.6–6.5	<2	Low	Low	Moderate
	25–60	2.0–6.0	0.11–0.20	5.1–6.0	<2	Low	Low	Moderate
	60–73	0.6–2.0	0.12–0.17	5.1–6.5	<2	Low	Low	Moderate
Larue: 53	0–26	6.0–20	0.05–0.10	5.6–6.5	<2	Low	Low	Moderate
	26–60	0.6–2.0	0.10–0.15	5.6–6.5	<2	Low	Moderate	Moderate
	60–74	0.6–2.0	0.10–0.15	5.6–6.5	<2	Low	Moderate	Moderate
Madill: 54	0–16	2.0–6.0	0.11–0.16	5.6–7.3	<2	Low	Low	Moderate
	16–30	2.0–6.0	0.11–0.16	5.6–7.3	<2	Low	Low	Moderate
	30–68	2.0–6.0	0.07–0.16	5.6–8.4	<2	Low	Low	Moderate
Matoy: 55	0–10	0.2–0.6	0.15–0.22	6.1–7.8	<2	Moderate	Moderate	Low
	10–31	0.06–0.2	0.10–0.15	6.6–8.4	<2	High	High	Low
	31–38	0.06–0.2	0.10–0.15	7.4–8.4	<2	High	High	Low
	38–40							
Muldrow: 56	0–10	0.2–0.6	0.15–0.22	5.6–6.0	<2	Moderate	High	Moderate
	10–64	<0.06	0.10–0.15	6.1–8.4	<2	High	High	Low
Muskogee: 57, 58, 59, 60	0–26	0.6–2.0	0.16–0.24	5.1–6.0	<2	Low	Moderate	Moderate
	26–42	0.2–0.6	0.16–0.24	5.1–6.0	<2	Moderate	High	Moderate
	42–62	0.06–0.2	0.14–0.18	5.6–7.8	<2	High	High	Moderate
Norwood: 61	0–27	0.6–2.0	0.17–0.21	7.9–8.4	<2	Low	High	Low
	27–60	0.6–2.0	0.15–0.22	7.9–8.4	<2	Low	High	Low
Okay: 62, 63, 64	0–17	2.0–6.0	0.11–0.16	5.6–6.5	<2	Low	Low	Moderate
	17–55	0.6–2.0	0.12–0.18	5.6–6.5	<2	Low	Moderate	Moderate
	55–68	0.6–6.0	0.11–0.17	5.6–7.3	<2	Low	Low	Moderate
Oklared:								
65	0–7	2.0–6.0	0.12–0.16	7.9–8.4	<2	Low	Low	Low
	7–24	2.0–6.0	0.12–0.16	7.9–8.4	<2	Low	Low	Low
	24–60	2.0–20	0.10–0.16	7.9–8.4	<2	Low	Low	Low
66	0–7	2.0–6.0	0.18–0.22	7.9–8.4	<2	Moderate	Moderate	Low
	7–24	2.0–6.0	0.12–0.16	7.9–8.4	<2	Low	Low	Low
	24–60	2.0–20	0.10–0.16	7.9–8.4	<2	Low	Low	Low

TABLE 16.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion	
							Uncoated steel	Concrete
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*			
Parsons: 67	0–14	0.6–2.0	0.16–0.24	5.1–6.5	<2	Low	High	Moderate
	14–62	<0.06	0.10–0.15	5.1–7.8	<2	High	High	Moderate
Pits: 68.								
Pledger: 69	0–8	0.06–0.2	0.10–0.15	6.1–8.4	<2	High	High	Low
	8–76	<0.06	0.10–0.15	7.9–8.4	<2	High	High	Low
Redport: 70	0–74	0.6–2.0	0.15–0.24	7.4–8.4	<2	Moderate	Moderate	Low
San Saba: [1] 71:								
San Saba part	0–26	<0.06	0.10–0.15	7.4–8.4	<2	Very high	High	Low
	26–30							
Tarrant part	0–16	0.2–0.6	0.10–0.17	7.9–8.4	<2	High	High	Low
	16–20							
Severn: 72	0–10	2.0–6.0	0.12–0.16	7.9–8.4	<2	Low	Low	Low
	10–74	2.0–6.0	0.13–0.17	7.9–8.4	<2	Low	Low	Low
Ships: 73, 74	0–73	<0.06	0.14–0.19	7.9–8.4	<2	Very high	High	Low
Tarrant: 75	0–16	0.2–0.6	0.10–0.17	7.9–8.4	<2	High	High	Low
	16–20							
Trinity: 76	0–10	0.06–0.2	0.10–0.15	7.4–8.4	<2	High	High	Low
	10–60	<0.06	0.10–0.15	7.9–8.4	<2	High	High	Low
Tullahassee: 77	0–14	2.0–6.0	0.12–0.16	5.6–6.5	<2	Low	Moderate	Moderate
	14–60	2.0–6.0	0.12–0.16	5.6–6.5	<2	Low	Moderate	Moderate
Verdigris: 78	0–24	0.6–2.0	0.22–0.24	5.6–7.3	<2	Moderate	Low	Low
	24–60	0.6–2.0	0.17–0.22	5.6–7.3	<2	Moderate	Low	Low
Woodson: 79	0–9	0.2–0.6	0.22–0.24	5.6–6.5	<2	Low	Moderate	Low
	9–50	<0.06	0.10–0.15	5.6–7.3	<2	High	High	Low
	50–60	<0.2	0.10–0.15	6.1–7.8	<2	High	High	Moderate
Woodtell: 80	0–6	0.6–2.0	0.10–0.15	5.6–6.5	<2	Low	Moderate	High
	6–41	<0.06	0.10–0.15	5.6–7.3	<2	High	High	High
	41–63	0.06–0.2	0.10–0.15	6.1–7.8	<2	High	High	High

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and bel unit.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops and ornamental or other plants to be grown, in evaluating soil amendments for fertility and stabilization, and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Estimates are based on field and laboratory measurements at representative sites of the non-irrigated soils. The salinity of individual irrigated fields is largely affected by the quality of the irrigation water and the irrigation practices. Hence, the salinity of individual fields can differ greatly from the value given in table 16. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion, as used in table 16, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Erosion factors. As used in table 16, soil erodibility factor (K) is a measure of the susceptibility of soil particles to detach and transport by rainfall and runoff. Soil loss tolerance (T) is the maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely. The number represents tons of soil loss per acre per year.

Wind erodibility groups are used to predict the susceptibility of soils to blowing and to predict the amount of soil lost by blowing. Each group consists of soils that have similar properties that affect their resistance to soil blowing. The main properties considered are those that determine the stability of aggregates that resist breakdown by tillage and abrasion by wind. Among those properties are texture, content of organic matter, content of calcium carbonate, soil moisture, mineralogical composition, susceptibility to frost action, and size of aggregates. The wind erodibility group number indicates the relative susceptibility of the soils to blowing. The higher the group number, the less susceptible the soils are to soil blowing; soils in group 1 are most susceptible, and those in group 8 are generally not susceptible.

Soil and Water Features

Features that relate to runoff or infiltration of water, to flooding, or to grading and excavation of each soil are indicated in table 17. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding and a seasonal high water table, and by the presence of bedrock in the upper 5 or 6 feet of the soil.

Hydrologic groups are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil.

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based on evidences in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; absence of distinctive soil horizons that form in soils of the area that are not subject to flooding; local information about floodwater heights and the extend of flooding; and local knowledge that relates the unique landscape position of each soil to historic floods. Most soils in low positions on the landscape where flooding is likely to occur are classified as fluvents at the suborder level or as fluventic subgroups. See the section "Classification."

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

A high water table is the highest level of a saturated zone more than 6 inches thick in soils for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of the soil survey. Indicated are the depth to the seasonal high water table; the kind of water table, whether perched, artesian, or the upper part of the ground water table; and the months of the year that the high water commonly is present. Only those saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table

TABLE 17.—*Soil and water features*

[Absence of an entry indicates the feature is not a concern. See Glossary for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than ; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			*In*	
Bates: 1	B	None			>6.0			20–40	Rippable.
Bernow:									
2, 3, 4, 5, 6, 10	B	None			>6.0			>60	
[17]:									
Bernow part	B	None			>6.0			>60	
Bosville part	D	None			1.0–2.0	Perched	Feb.–July	>60	
[18]:									
Bernow part	B	None			>6.0			>60	
Romia part	B	None			>6.0			40–60	Rippable.
[19]:									
Bernow part	B	None			>6.0			>60	
Romia part	B	None			>6.0			40–60	Rippable.
Bosville: 11, 12	D	None			1.0–2.0	Perched	Feb.–July	>60	
Boxville: 13, 14	B	None			>6.0			>60	
Burleson: 15, 16, 17	D	None			>6.0			>60	
Catoosa: [18]:									
Catoosa part	B	None			>6.0			20–40	Hard.
Claremore part	D	None			>6.0			10–20	Hard.
Collinsville: 19	C	None			>6.0			4–20	Hard.
Crockett:									
20, 22	D	None			>6.0			>60	
[21]:									
Crockett part	D	None			>6.0			>60	
Durant part	D	None			>6.0			>60	
Dennis: 23, 24, 25	C	None			2.0–3.0	Perched	Dec.–Apr.	>60	
Durant:									
26, 27	D	None			>6.0			>60	
[28]:									
Durant part	D	None			>6.0			>60	
Verdigris part	B	Frequent	Brief	Dec.–June	>6.0			>60	
Eufaula: 29	A	None			>6.0			>60	
Ferris:									
30, 31	D	None			>6.0			>60	
[32]:									
Ferris part	D	None			>6.0			>60	
Romia part	B	None			>6.0			40–60	Rippable.
[33]:									
Ferris part	D	None			>6.0			>60	
Tarrant part	D	None			>6.0			6–20	Hard.
Fitzhugh:									
34	B	None			>6.0			40–60	Rippable.
[35]:									
Fitzhugh part	B	None			>6.0			40–60	Rippable.
Bates part	B	None			>6.0			20–40	Rippable.
Freestone: 36	C	None			1.0–3.0	Apparent	Dec.–May	>60	
Frioton: 37	B	Occasional	Very brief	Feb.–July	>6.0			>60	
Gowton: 38	B	Occasional	Very brief	Feb.–July	>6.0			>60	
Guyton: 39	D	Rare	Very brief to long.	Jan.–Dec.	0–1.5	Apparent	Dec.–May	>60	
Heiden: 40, 41	D	None			>6.0			>60	

TABLE 17.—*Soil and water features*—Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			*In*	
Karma: 42, 43, 44, 45	B	None			>6.0			>60	
Kaufman: 46, 47	D	Occasional, frequent.	Brief or long.	Feb.–July	0–3.5	Apparent	Nov.–April	>60	
Kiomatia: 48, [1]49, 50	A	Rare or frequent.	Brief	Feb.–June	3.0–5.0	Apparent	Jan.–July	>60	
Larton: 51, 52	B	None			>6.0			>60	
Larue: 53	A	None			>6.0			>60	
Madill: 54	B	Occasional	Very brief	Feb.–July	>6.0			>60	
Matoy: 55	D	None			>6.0			20–40	Hard.
Muldrow: 56	D	Rare	Brief	Feb.–July	0–2.0	Apparent	Sep.–March	>60	
Muskogee: 57, 58, 59, 60	C	None			>6.0			>60	
Norwood: 61	B	Rare	Very brief	Feb.–July	>6.0			>60	
Okay: 62, 63, 64	B	None			>6.0			>60	
Oklared: 65, 66	B	Rare	Very brief	March–Aug.				>60	
Parsons: 67	D	None			0.5–1.5	Perched	Dec.–April	>60	
Pits: 68.									
Pledger: 69	D	Rare	Brief	Feb.–July	0–2.5	Apparent	Dec.–Feb.	>60	
Redport: 70	B	Rare	Very brief	March–Aug.	>6.0			>60	
San Saba: [1]71:									
San Saba part	D	None			>6.0			29–40	Hard.
Tarrant part	D	None			>6.0			6–20	Hard.
Severn: 72	B	Rare	Very brief	March–Aug.	>6.0			>60	
Ships: 73, 74	D	Rare or frequent.	Brief or long.	Feb.–July	>6.0			>60	
Tarrant: 75	D	None			>6.0			6–20	Hard.
Trinity: 76	D	Occasional	Brief	Feb.–July	0–3.0	Apparent	Nov.–Feb.	>60	
Tullahassee: 77	C	Frequent	Brief	March–Aug.	2.0–3.0	Apparent	Nov.–May	>60	
Verdigris: 78	B	Occasional	Brief	Feb.–July	>6.0			>60	
Woodson: 79	D	None			0.5–2.0	Perched	Dec.–April	>60	
Woodtell: 80	D	None			1.5–4.0	Apparent	Dec.–Feb.	>60	

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at depths of 5 to 6 feet or less. For many soils, limited range in depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and other observations during the soil mapping. The kind of bedrock and its relative hardness as related to ease of excavation is also shown. Rippable

bedrock can be excavated with a single-tooth ripping attachment on a 200 horsepower tractor, but hard bedrock generally requires blasting.

Engineering Test Data

Table 18 contains engineering test data for some of the major soil series in Bryan County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as has been explained for table 15.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when ovendry.

Volume change from FME. The field moisture equivalent (FME) is the minimum moisture at which a smooth soil surface will absorb no more water within 30 seconds when the water is added in individual drops. It is the moisture content required to fill all the pores in sands and to approach saturation in cohesive soils. The volume change from FME is the volume change, expressed as a percentage of the dry volume of the soil mass, when the moisture content is reduced from FME to shrinkage limit.

Formation and Classification of the Soils

This section discusses the five major factors of soil formation as they affect the formation of soils. It also explains the current system for classifying soils in higher categories.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and has existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) length of time the forces of soil formation have acted on the parent material.

Climate and vegetation are the active factors in soil formation. They act on the parent material accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the nature of the profile and, in extreme instances, determines it almost entirely. Finally, time is needed to change the parent material into a soil profile. Generally, a long time is required to develop a profile that has distinct horizons.

The five factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Classification

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965[8]. Readers interested in further details about the system should refer to the latest literature available.

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19 the soils of the survey area are classified according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-farming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol. Four of the ten orders are recognized in Bryan County.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth or were selected to reflect the most important variable within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvents (*Fluv*,

[8]United States Department of Agriculture. 1960. Soil classification, a comprehensive system, 7th approximation. 265 pp. illus. (Supplements issued in March 1967 and September 1968)

meaning produced by stream action, and *ent,* from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Udifluvents (*Udi,* meaning humid climate, *fluv,* meaning produced by stream action, and *ent,* from Entisols).

SUBGROUP. Each great group is divided into three subgroups: The central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Aquic Udifluvents (a wet Udifluvent).

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents.

SERIES. The series consists of a group of soils that are formed from a particular kind of parent material and have horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Be-

TABLE 18.—*Engineering*

Soil name and location	Parent material	Depth	Shrinkage limit	Shrinkage ratio	Volume charge from FME	Mechanical analysis[2]	
						Percentage passing sieve—	
						1 inch	No. 4 (4.7 mm)
		In					
Bernow fine sandy loam:	Sandy and loamy	0–8	[5]NP	NP	NP	100	100
2,110 feet east and 20 feet south of	sediment.	21–38	13	1.90	32		
the northwest corner of sec. 33,		38–49	15	1.85	14		
T. 6 S., R. 13 E.		49–61	16	1.80	7	100	96
		61–85	14	1.86	26		
Boxville fine sandy loam:	Loamy and clayey	0–8	16	1.77	34		
1,890 feet east and 20 feet south at	sediment.	8–19	13	1.97	62		
the northwest corner of sec. 33,		19–35	10	2.07	80		
T. 6 S., R. 14 E.		35–44	9	2.08	82		
		44–57	4	2.35	115		
		57–66	11	2.05	74		
Burleson clay:	Clayey sediment.	0–16	9	2.07	106		
315 feet south and 60 feet east of		25–40	8	2.08	108		
the northwest corner of sec. 11,							
T. 5 S., R. 9 E.							
Dennis loam:	Loamy and clayey	0–11	17	1.71	27		
620 feet west and 100 feet north of	sediment.	15–38	11	1.95	68		
the southeast corner of sec. 26,		56–65	10	2.02	69		
T. 6 S., R. 8 E.							
Durant loam:	Loamy and clayey	0–10	15	1.79	28		
1,000 feet west and 330 feet north of	sediment.	10–18	11	2.00	80		
the southeast corner of sec. 30,		18–38	10	2.02	82		
T. 5 S., R. 10 E.		38–48	9	2.09	94		
		48–60	9	2.11	88		
Guyton silt loam:	Loamy sediment.	0–8	20	1.73	4		
440 feet west and 2,700 feet north of		8–17	17	1.77	4		
the southeast corner of sec. 36,		17–26	12	1.94	49		
T. 7 S., R. 13 E.		26–42	15	1.91	28		
		42–57	10	1.93	34		
Norwood silt loam:	Loamy sediment.	0–9	17	1.75	17		
880 feet north and 1,385 feet west of		9–27	16	1.82	28		
the southeast corner of sec. 13,		38–58	12	1.96	58		
T. 9 S., R. 10 E.							

[1]Tests performed by State of Oklahoma, Department of Highways, Materials Division.

[2]Mechanical analyses according to the AASHTO Designation T 88 (see footnote 7, p. 90). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the materials, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine

cause they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

test data[1]—Continued

Mechanical analysis[2]—Cont.						Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Cont.			Percentage smaller than—					AASHTO[3]	Unified[4]
No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
						Pct			
99	97	33	20	3	1	NP	NP	A–2–4(0)	SM
100	100	63	53	28	25	32	13	A–6(6)	CL
100	100	55	45	21	18	24	8	A–4(1)	CL
96	95	51	36	18	14	23	8	A–4(1)	CL
100	100	59	48	32	30	32	14	A–6(6)	CL
100	99	90	81	31	25	39	17	A–6(16)	CL
100	100	96	92	55	47	59	35	A–7–6(38)	CH
100	100	97	92	55	41	56	33	A–7–6(36)	CH
100	100	98	95	55	48	55	32	A–7–6(35)	CH
100	100	98	94	62	51	63	41	A–7–6(46)	CH
100	100	99	96	65	54	60	34	A–7–6(39)	CH
100	99	97	92	54	46	67	33	A–7–5(40)	MH
100	98	94	92	56	49	66	38	A–7–6(42)	CH
100	98	69	56	20	16	35	11	A–6(7)	CL
100	100	83	77	48	44	51	24	A–7–6(22)	CH
100	100	90	82	47	40	56	32	A–7–6(32)	CH
100	99	88	80	26	20	34	13	A–6(11)	CL
100	98	93	87	53	45	61	32	A–7–6(35)	CH
100	99	96	90	56	49	61	32	A–7–6(37)	CH
100	99	94	90	55	48	66	38	A–7–6(41)	CH
100	98	93	89	53	45	56	33	A–7–6(34)	CH
100	99	90	77	16	8	24	5	A–4(3)	CL–ML
100	99	88	74	14	7	19	1	A–4(0)	ML
100	100	89	80	39	35	45	26	A–7–6(24)	CL
100	100	89	79	34	30	37	20	A–6(18)	CL
100	100	85	70	29	26	34	17	A–6(13)	CL
100	100	96	83	21	15	27	8	A–4(6)	CL
100	100	100	97	26	21	34	14	A–6(14)	CL
100	100	99	97	48	40	43	22	A–7–6(24)	CL

material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table arenot suitable for use in textural classes for soil.

[3]Based on AASHTO Designation M 145-49.

[4]Based on the Unified soil classification system (see footnote 6, p. 90).

[5]NP means nonplastic.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage surface. Runoff, or surface flow of water, from an area.

TABLE 19.—*Classification of the soils*

Soil name	Family or higher taxonomic class
Bates	Fine-loamy, siliceous, thermic Typic Argiudolls.
Bernow	Fine-loamy, siliceous, thermic Glossic Paleudalfs.
Bosville	Fine, mixed, thermic Albaquic Paleudalfs.
Boxville	Fine, mixed, thermic Typic Paleudalfs.
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts.
Catoosa	Fine-silty, mixed, thermic Typic Argiudolls.
Claremore	Loamy, mixed, thermic Lithic Argiudolls.
Collinsville	Loamy, siliceous, thermic Lithic Hapludolls.
[1]Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs.
Dennis	Fine, mixed, thermic Aquic Paleudolls.
Durant	Fine, montmorillonitic, thermic Vertic Argiustolls.
Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs.
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts.
Fitzhugh	Fine-loamy, mixed, thermic Typic Argiudolls.
Freestone	Fine-loamy, siliceous, thermic Glossaquic Paleudalfs.
Frioton	Fine, mixed, thermic Cumulic Hapludolls.
Gowton	Fine-loamy, mixed, thermic Cumulic Hapludolls.
Guyton	Fine-silty, siliceous, thermic Typic Glossaqualfs.
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts.
Karma	Fine-loamy, mixed, thermic Typic Hapludalfs.
Kaufman	Very-fine, montmorillonitic, thermic Typic Pelluderts.
Kiomatia	Sandy, mixed, thermic Typic Udifluvents.
Larton	Loamy, siliceous, thermic Arenic Paleudalfs.
Larue	Loamy, siliceous, thermic Arenic Paleudalfs.
Madill	Coarse-loamy, mixed, nonacid, thermic Typic Udifluvents.
Matoy	Fine, montmorillonitic, thermic Vertic Haplustolls.
Muldrow	Fine, mixed, thermic Typic Argiaquolls.
Muskogee	Fine-silty, mixed, thermic Acquic Paleudalfs.
Norwood	Fine-silty, mixed (calcareous), thermic Typic Udifluvents.
Okay	Fine-loamy, mixed, thermic Typic Argiudolls.
Oklared	Coarse-loamy, mixed, (calcareous) thermic Typic Udifluvents.
Parsons	Fine, mixed, thermic Mollic Albaqualfs.
Pledger	Fine, mixed, thermic Vertic Hapludolls.
Redport	Fine-silty, mixed, thermic Cumulic Hapludolls.
Romia	Fine-loamy, siliceous, thermic Ultic Hapludalfs.
San Saba	Fine, montmorillonitic, thermic, Udic Pellusterts.
Severn	Coarse-silty, mixed (calcareous), thermic Typic Udifluvents.
Ships	Very-fine, mixed, thermic Udertic Haplustolls.
[2]Tarrant	Clayey-skeletal, montmorillonitic, thermic Lithic Calciustolls.
Trinity	Very-fine, montmorillonitic, thermic Typic Pelluderts.
Tullahassee	Coarse-loamy, mixed, nonacid, thermic Aquic Udifluvents.
Verdigris	Fine-silty, mixed, thermic Cumulic Hapludolls.
Woodson	Fine, mixed, thermic Abruptic Argiaquolls.
[3]Woodtell	Fine, montmorillonitic, thermic Vertic Hapludalfs.

[1]The Crockett soils in the Crockett-Durant complex are taxadjuncts to the series. They lack distinct and coarse mottling in the upper part of the argillic horizon.

[2]The Tarrant soils are taxadjuncts to the series. They are moist for longer periods of time, and in about 40 percent of the pedons the color in the upper part of the A horizon is in chroma of 1. In addition, the A horizon does not extend into crevices of the underlying limestone.

[3]The Woodtell soils are taxadjuncts to the series. These soils have subsoil colors of slightly lower chroma than is allowed in the series and in addition, they have thicker solum.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym; natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not probable; rare that it is unlikely but possible under unusual weather conditions; occasional that it occurs on an average of once or less in 2 years; and frequent that it occurs on an average of more than once in 2 years. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, and long if more than 7 days. Probable dates are expressed in months; November-May, for example, means the flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like

or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbances of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulky density is greater than that of organic soil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistency, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Range (or rangeland). Land that, for the most part, produces native plans suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—excellent, good, fair, and poor. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: very coarse sand (2.0 millimeters to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.05 to 0.002 millimeter); and clay (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally,

the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separate from adjoining aggregates. The principal formsof soil structure are — platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs.

Map symbol	Mapping unit	Page	Capability unit	Range site	Woodland group
1	Bates fine sandy loam, 1 to 3 percent slopes	6	IIe-1	Loamy Prairie	--
2	Bernow loamy fine sand, 3 to 8 percent slopes	8	IVe-1	----------	4o
3	Bernow fine sandy loam, 1 to 3 percent slopes	8	IIe-2	----------	4o
4	Bernow fine sandy loam, 3 to 5 percent slopes	8	IIIe-4	----------	4o
5	Bernow fine sandy loam, 5 to 8 percent slopes	8	IVe-2	----------	4o
6	Bernow fine sandy loam, 8 to 12 percent slopes	8	VIe-3	----------	4o
7	Bernow-Bosville complex, 2 to 5 percent slopes, eroded	9	IIIe-5	----------	--
	Bernow part	--	------	----------	4o
	Bosville part	--	------	----------	4c
8	Bernow-Romia complex, 3 to 8 percent slopes	9	IVe-1	----------	--
	Bernow part	--	------	----------	4o
	Romia part	--	------	Sandy Savannah	4f
9	Bernow-Romia complex, 8 to 20 percent slopes	9	VIe-2	----------	--
	Bernow part	--	------	----------	4o
	Romia part	--	------	Sandy Savannah	4f
10	Bernow soils, 2 to 8 percent slopes, severely eroded	9	VIe-5	----------	4o
11	Bosville fine sandy loam, 2 to 5 percent slopes	10	IVe-2	----------	4c
12	Bosville fine sandy loam, 5 to 8 percent slopes	10	VIe-3	----------	4c
13	Boxville fine sandy loam, 1 to 3 percent slopes	11	IIIe-4	Loamy Savannah	4o
14	Boxville fine sandy loam, 3 to 8 percent slopes	11	IVe-2	Loamy Savannah	4o
15	Burleson clay, 0 to 1 percent slopes	12	IIw-3	Blackclay Prairie	--
16	Burleson clay, 1 to 3 percent slopes	12	IIe-3	Blackclay Prairie	--
17	Burleson clay, 3 to 5 percent slopes	12	IIIe-3	Blackclay Prairie	--
18	Catoosa-Claremore complex, 1 to 3 percent slopes	13	IIe-1	Loamy Prairie	--
19	Collinsville fine sandy loam, 3 to 12 percent slopes	14	VIs-1	Shallow Prairie	--
20	Crockett loam, 1 to 3 percent slopes	15	IIIe-2	Claypan Prairie	--
21	Crockett-Durant complex, 1 to 5 percent slopes, eroded	15	IVe-3	----------	--
	Crockett part	--	------	Claypan Prairie	--
	Durant part	--	------	Loamy Prairie	--
22	Crockett soils, 1 to 6 percent slopes, severely eroded	15	VIe-5	Eroded Clay	--
23	Dennis loam, 0 to 1 percent slopes	16	I-2	Loamy Prairie	--
24	Dennis loam, 1 to 3 percent slopes	16	IIe-1	Loamy Prairie	--
25	Dennis loam, 3 to 5 percent slopes	16	IIIe-2	Loamy Prairie	--
26	Durant loam, 1 to 3 percent slopes	17	IIe-1	Loamy Prairie	--
27	Durant loam, 3 to 5 percent slopes	18	IIIe-2	Loamy Prairie	--
28	Durant-Verdigris complex	18	VIe-4	----------	--
	Durant part	--	------	Loamy Prairie	--
	Verdigris part	--	------	----------	2o
29	Eufaula fine sand, 3 to 15 percent slopes	18	VIe-6	Deep Sand Savannah	--
30	Ferris clay, 1 to 5 percent slopes, eroded	19	IVe-3	Blackclay Prairie	--
31	Ferris clay, 8 to 20 percent slopes	19	VIe-1	Blackclay Prairie	--
32	Ferris-Romia complex, 5 to 20 percent slopes	19	VIe-3	----------	--
	Ferris part	--	------	Blackclay Prairie	--
	Romia part	--	------	Sandy Savannah	4f
33	Ferris-Tarrant complex, 8 to 20 percent slopes	20	VIe-1	----------	--
	Ferris part	--	------	Blackclay Prairie	--
	Tarrant part	--	------	Very Shallow	--
34	Fitzhugh fine sandy loam, 3 to 5 percent slopes	20	IIIe-2	Loamy Prairie	--
35	Fitzhugh-Bates complex, 1 to 5 percent slopes, eroded	20	IIIe-5	Loamy Prairie	--
36	Freestone fine sandy loam, 1 to 5 percent slopes	21	IIIe-4	Loamy Savannah	3w
37	Frioton silty clay loam	22	IIw-2	----------	2o
38	Gowton loam	22	IIw-2	----------	2o
39	Guyton silt loam	23	IIIw-1	----------	3w
40	Heiden clay, 3 to 5 percent slopes	24	IIIe-3	Blackclay Prairie	--

Map symbol	Mapping unit	Page	Capability unit	Range site	Woodland group
41	Heiden stony soils, 2 to 5 percent slopes	24	VIe-1	Blackclay Prairie	--
42	Karma fine sandy loam, 1 to 3 percent slopes	24	IIe-2	Loamy Savannah	3o
43	Karma fine sandy loam, 3 to 5 percent slopes	24	IIIe-4	Loamy Savannah	3o
44	Karma fine sandy loam, 2 to 5 percent slopes, eroded	25	IIIe-5	Loamy Savannah	3o
45	Karma fine sandy loam, 8 to 20 percent slopes	25	VIe-3	Loamy Savannah	3o
46	Kaufman clay	25	IIw-4	----------	2w
47	Kaufman clay, depressional	26	Vw-1	----------	3w
48	Kiomatia fine sandy loam	26	IIIs-1	----------	2o
49	Kiomatia complex	26	IIIs-1	----------	3s
50	Kiomatia soils	27	Vw-2	----------	2o
51	Larton loamy fine sand, 1 to 3 percent slopes	27	IIIe-1	----------	3o
52	Larton loamy fine sand, 3 to 5 percent slopes	28	IVe-1	----------	3o
53	Larue loamy fine sand, 0 to 3 percent slopes	28	IIIs-2	Sandy Savannah	3s
54	Madill fine sandy loam	29	IIw-2	----------	2o
55	Matoy silty clay loam, 1 to 3 percent slopes	29	IIe-3	Blackclay Prairie	--
56	Muldrow silty clay loam	30	IIw-1	----------	2w
57	Muskogee silt loam, 0 to 1 percent slopes	31	I-2	Loamy Savannah	3o
58	Muskogee silt loam, 1 to 3 percent slopes	31	IIe-2	Loamy Savannah	3o
59	Muskogee silt loam, 3 to 5 percent slopes	31	IIIe-4	Loamy Savannah	3o
60	Muskogee silt loam, 2 to 5 percent slopes, eroded	31	IIIe-5	Loamy Savannah	3o
61	Norwood silt loam	32	I-1	----------	2o
62	Okay fine sandy loam, 0 to 1 percent slopes	33	I-2	Loamy Prairie	--
63	Okay loam, 0 to 1 percent slopes	33	I-2	Loamy Prairie	--
64	Okay loam, 1 to 3 percent slopes	34	IIe-1	Loamy Prairie	--
65	Oklared fine sandy loam	35	I-1	----------	2o
66	Oklared silty clay loam	35	I-1	----------	2o
67	Parsons silt loam, 0 to 1 percent slopes	36	IIs-1	Claypan Prairie	--
68	Pits	36	VIIs-2	----------	--
69	Pledger clay	37	IIs-2	----------	3w
70	Redport silty clay loam	38	I-1	----------	2o
71	San Saba-Tarrant complex, 1 to 8 percent slopes	39	VIe-1	----------	--
	San Saba part	--	------	Blackclay Prairie	--
	Tarrant part	--	------	Very Shallow	--
72	Severn fine sandy loam	40	I-1	----------	2o
73	Ships clay	40	IIs-3	----------	3w
74	Ships clay, depressional	40	Vw-1	----------	3w
75	Tarrant soils, 1 to 8 percent slopes	41	VIIs-1	Very Shallow	--
76	Trinity clay	41	IIw-4	----------	3w
77	Tullahassee fine sandy loam	42	Vw-2	----------	3w
78	Verdigris silty clay loam	43	IIw-2	----------	2o
79	Woodson silt loam, 0 to 1 percent slopes	43	IIs-1	Claypan Prairie	--
80	Woodtell loam, 2 to 5 percent slopes	44	IVe-2	----------	4c

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SOIL ASSOCIATIONS

1 VERDIGRIS–KAUFMAN–KIOMATIA association: Deep, nearly level, well drained to somewhat poorly drained, sandy to clayey soils that have a sandy to clayey subsoil over sandy to clayey sediment; on flood plains

2 MUSKOGEE–BOXVILLE association: Deep, nearly level to sloping, moderately well drained or well drained, loamy soils that have a loamy or clayey subsoil over loamy or clayey sediment; on uplands

3 BERNOW–BOSVILLE association: Deep, very gently sloping to sloping, moderately well drained or well drained, loamy or sandy soils that have a loamy or clayey subsoil over loamy or clayey sediment; on uplands

4 BURLESON–FERRIS association: Deep, nearly level to gently sloping, moderately well drained or well drained, clayey soils that have a clayey subsoil over clayey sediment or shaly clay; on uplands

5 FERRIS–TARRANT association: Deep to shallow, very gently sloping to moderately steep, well drained, clayey or cobbly clayey soils that have a clayey or cobbly clayey subsoil over shaly clay or limestone; on uplands

6 DURANT–DENNIS association: Deep, nearly level to gently sloping, moderately well drained, loamy soils that have a loamy or clayey subsoil over loamy and clayey sediment; on uplands

7 BERNOW–ROMIA association: Deep, strongly sloping to moderately steep, well drained, sandy or loamy soils that have a loamy subsoil over loamy sediment or sandstone; on uplands

Compiled 1977

VICINITY MAP

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

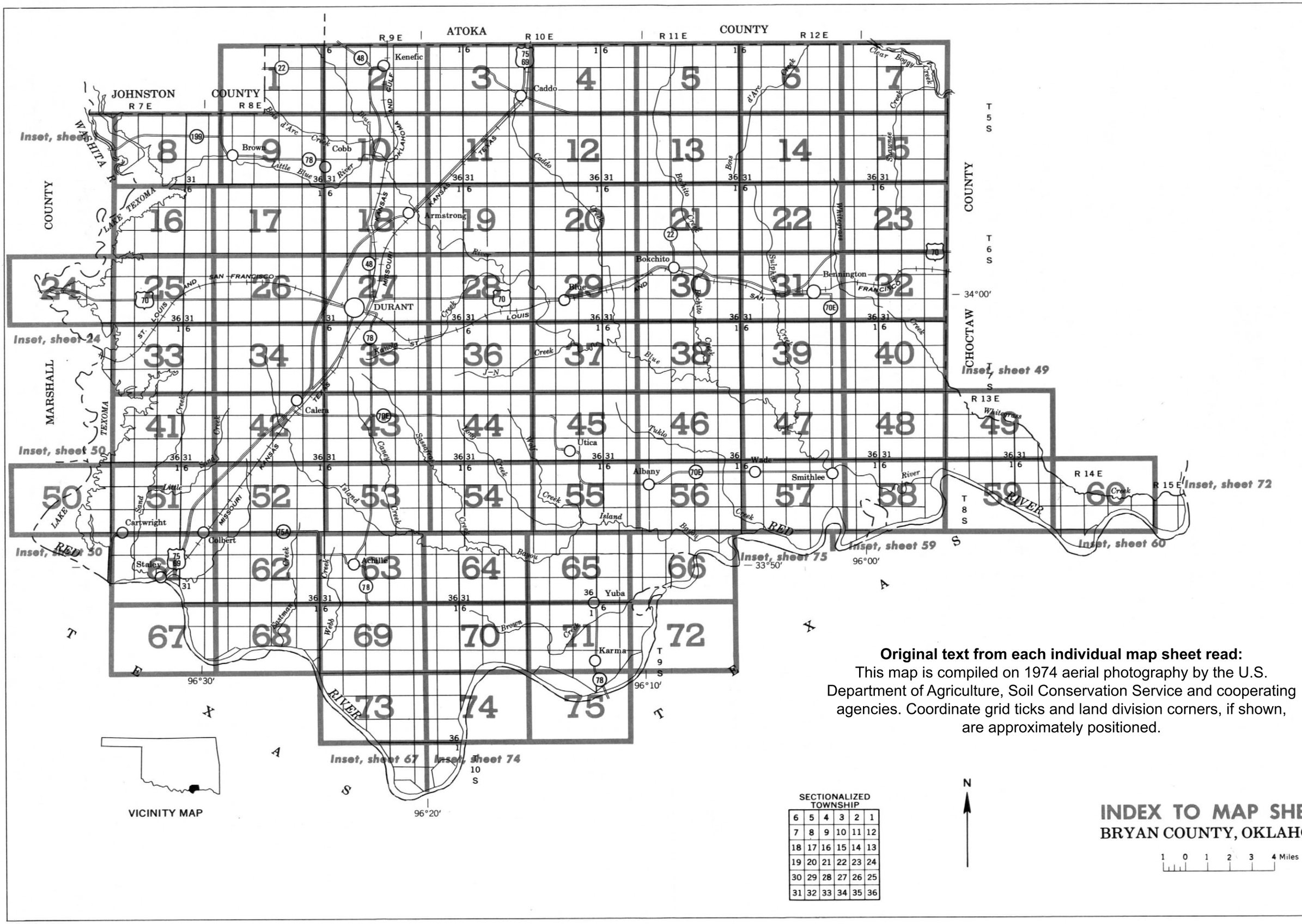
N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
BRYAN COUNTY, OKLAHOMA

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:
This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

INDEX TO MAP SHEETS
BRYAN COUNTY, OKLAHOMA

1 0 1 2 3 4 Miles

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

SOIL LEGEND

SYMBOL	NAME
1	Bates fine sandy loam, 1 to 3 percent slopes
2	Bernow loamy fine sand, 3 to 8 percent slopes
3	Bernow fine sandy loam, 1 to 3 percent slopes
4	Bernow fine sandy loam, 3 to 5 percent slopes
5	Bernow fine sandy loam, 5 to 8 percent slopes
6	Bernow fine sandy loam, 8 to 20 percent slopes
7	Bernow-Bosville complex, 2 to 5 percent slopes, eroded
8	Bernow-Romia complex, 3 to 8 percent slopes
9	Bernow-Romia complex, 8 to 20 percent slopes
10	Bernow soils, 2 to 8 percent slopes, severely eroded
11	Bosville fine sandy loam, 2 to 5 percent slopes
12	Bosville fine sandy loam, 5 to 8 percent slopes
13	Boxville fine sandy loam, 1 to 3 percent slopes
14	Boxville fine sandy loam, 3 to 8 percent slopes
15	Burleson clay, 0 to 1 percent slopes
16	Burleson clay, 1 to 3 percent slopes
17	Burleson clay, 3 to 5 percent slopes
18	Catoosa-Claremore complex, 1 to 3 percent slopes
19	Collinsville fine sandy loam, 3 to 12 percent slopes
20	Crockett loam, 1 to 3 percent slopes
21	Crockett-Durant complex, 1 to 5 percent slopes, eroded
22	Crockett soils, 1 to 6 percent slopes, severely eroded
23	Dennis loam, 0 to 1 percent slopes
24	Dennis loam, 1 to 3 percent slopes
25	Dennis loam, 3 to 5 percent slopes
26	Durant loam, 1 to 3 percent slopes
27	Durant loam, 3 to 5 percent slopes
28	Durant-Verdigris complex
29	Eufaula fine sand, 3 to 15 percent slopes
30	Ferris clay, 1 to 5 percent slopes, eroded
31	Ferris clay, 8 to 20 percent slopes
32	Ferris-Romia complex, 5 to 20 percent slopes
33	Ferris-Tarrant complex, 8 to 20 percent slopes
34	Fitzhugh fine sandy loam, 3 to 5 percent slopes
35	Fitzhugh-Bates complex, 1 to 5 percent slopes, eroded
36	Freestone fine sandy loam, 1 to 5 percent slopes
37	Frioton silty clay loam
38	Gowton loam
39	Guyton silt loam
40	Heiden clay, 3 to 5 percent slopes
41	Heiden stony soils, 2 to 5 percent slopes
42	Karma fine sandy loam, 1 to 3 percent slopes
43	Karma fine sandy loam, 3 to 5 percent slopes
44	Karma fine sandy loam, 2 to 5 percent slopes, eroded
45	Karma fine sandy loam, 8 to 20 percent slopes
46	Kaufman clay
47	Kaufman clay, depressional
48	Kiomatia fine sandy loam
49	Kiomatia complex
50	Kiomatia soils
51	Larton loamy fine sand, 1 to 3 percent slopes
52	Larton loamy fine sand, 3 to 5 percent slopes
53	Larue loamy fine sand, 0 to 3 percent slopes
54	Madill fine sandy loam
55	Matoy silty clay loam, 1 to 3 percent slopes
56	Muldrow silty clay loam
57	Muskogee silt loam, 0 to 1 percent slopes
58	Muskogee silt loam, 1 to 3 percent slopes
59	Muskogee silt loam, 3 to 5 percent slopes
60	Muskogee silt loam, 2 to 5 percent slopes, eroded
61	Norwood silt loam
62	Okay fine sandy loam, 0 to 1 percent slopes
63	Okay loam, 0 to 1 percent slopes
64	Okay loam, 1 to 3 percent slopes
65	Oklared fine sandy loam
66	Oklared silty clay loam
67	Parsons silt loam, 0 to 1 percent slopes
68	Pits
69	Pledger clay
70	Redport silty clay loam
71	San Saba-Tarrant complex, 1 to 8 percent slopes
72	Severn fine sandy loam
73	Ships clay
74	Ships clay, depressional
75	Tarrant soils, 1 to 8 percent slopes
76	Trinity clay
77	Tullahassee fine sandy loam
78	Verdigris silty clay loam
79	Woodson silt loam, 0 to 1 percent slopes
80	Woodtell loam, 2 to 5 percent slopes

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

JOHNSTON COUNTY

2 429 000 FEET

R. 7 E.

LAKE TEXOMA

CUMBERLAND LEVEE

LAKE TEXOMA

MARSHALL OLD COUNTY CHANNEL

T. 5 S.

285 000 FEET

280 000 FEET

(Joins sheet 8)

4000 AND 5000 FOOT GRID TICKS

2 433 000 FEET

2 470 000 FEET

R. 8 E.

JOHNSTON COUNTY

Horse Creek

water

TWELVEMILE

Blue River

PRAIRIE

Bois d'Arc Creek

300 000 FEET

290 000 FEET

(Joins sheet 2)

(Joins sheet 9)

2 480 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20000

(10)

N

1 Mile 5000 Feet

Scale · 1:20000

(Joins sheet 2)

R. 9 E.

2 505 000 FEET

285 000 FEET

T. 5 S.

(Joins sheet 9)

(Joins sheet 11)

275 000 FEET

2 485 000 FEET

(Joins sheet 18)

19 20 21 22 23 30 29 28 27 26 31 32 33 34 35

Blue River

Bois d'Arc Creek

Little Blue Creek

Simmons Creek

Johnson Creek

Oklahoma – Kansas Line

Simmons Lake

Durant State Fish Hatchery

Cobb

11

N

R. 9 E. | R. 10 E.

2510 000 FEET

(Joins sheet 3)

285 000 FEET

T. 5 S.

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 19)

2525 000 FEET

Johnson Creek

Caddo Creek

Thompson Creek

Wasseta

TEXAS

KANSAS

MISSOURI

CADDO HILLS

Durant State Fish Hatchery

1 Mile

5000 Feet

Scale 1:20000

N

(Joins sheet 4)

R. 10 E. | R. 11 E.

2 550 000 FEET

285 000 FEET

T. 5 S.

(Joins sheet 13)

(Joins sheet 11)

1 Mile

5000 Feet

Scale 1 : 20000

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

22 23 24 19 20

27 26 25 30 29

34 35 36 31 32

Elm Creek

Mud Creek

Cuddo Creek

Rocky Creek

Byarm Creek

2 530 000 FEET

275 000 FEET

(Joins sheet 20)

BRYAN COUNTY, OKLAHOMA — SHEET NUMBER 13

13

N

2 555 000 FEET

R. 11 E.

(Joins sheet 5)

285 000 FEET

T. 5 S.

(Joins sheet 12)

(Joins sheet 14)

Sevenmile Corner

Bokchito Creek

Pritchard

Little Bokchito Creek

water

Banty

20 21 22 23 24

29 28 27 26 25

32 33 34 35 36

(Joins sheet 21)

2 575 000 FEET

1 Mile

5 000 Feet

Scale 1:20000

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

275 000 FEET

N

(Joins sheet 6)

R. 12 E.

2 600 000 FEET

Tenmile Hill

Tenmile Creek

Straight Creek

Sugarloaf Mountain

Bois d'Arc Creek

Dancing Rabbit Creek

Attucapa Spring

19 20 21 22 23

30 29 28 27 26

31 32 33 34 35

(Joins sheet 13)

(Joins sheet 15)

T. 5 S.

285 000 FEET

275 000 FEET

2 580 000 FEET

(Joins sheet 22)

1 Mile

5000 Feet

Scale · 1 : 20000

15

2 605 000 FEET

R. 12 E. | R. 13 E.

(Joins sheet 7)

285 000 FEET

T. 5 S.

(Joins sheet 14)

Rabbit Creek

Dancing

Cade

Creek

Shatmee

Timber Hill

Pecan Branch

2 620 000 FEET

(Joins sheet 23)

N

1 Mile

5 000 Feet

Scale 1:20000

CHOCTAW COUNTY

275 000 FEET

16

N

Scale 1:20000

1 Mile 5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 8)

R. 7 E. | R. 8 E.

2 455 000 FEET

270 000 FEET

T. 6 S.

MARSHALL COUNTY

LAKE TEXOMA

260 000 FEET

2 435 000 FEET

(Joins sheet 25)

(Joins sheet 17)

(Joins sheet 8) | (Joins sheet 9)

2 460 000 FEET

R. 8 E.

270 000 FEET

T. 6 S.

(Joins sheet 16)

Little Missouri River

Silo

(Joins sheet 18)

260 000 FEET

(Joins sheet 26)

2 480 000 FEET

17

N

1 Mile

5,000 Feet

Scale 1:20000


N
(Joins sheet 10)
R. 9 E.
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 27)
T. 6 S.
2 505 000 FEET
270 000 FEET
260 000 FEET
2 485 000 FEET
Durant State Fish Hatchery
BLUE RIVER DAM
Little Blue River
BLUE RIVER
Ury
Armstrong
water
Mineral Bayou
MISSOURI KANSAS TEXAS
OKLAHOMA AND GULF
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000


R. 9 E.
R. 10 E.
2 510 000 FEET
270 000 FEET
T. 6 S.
Durant State Fish Hatchery
TEXAS
KANSAS
MISSOURI
Thompson Creek
Harrington Creek
Sandy Creek
CADDO HILLS
Dude Creek
BLUE RIVER
(Joins sheet 11)
(Joins sheet 20)
(Joins sheet 18)
(Joins sheet 28)
2 530 000 FEET
260 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20000

(2)

N

ATOKA COUNTY

R. 9 E.

2 505 000 FEET

300 000 FEET

T. 5 S.

Kenefic

McClellan Creek

BLUE RIVER

GULF, COLORADO AND SANTA FE RAILWAY

OKLAHOMA

KANSAS

Simon Creek

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 10)

2 485 000 FEET

290 000 FEET

1 Mile

5 000 Feet

Scale · 1 : 20000

0 0

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000


N
(Joins sheet 12)
R. 10 E.
R. 11 E.
2 550 000 FEET
270 000 FEET
T. 6 S.
(Joins sheet 21)
(Joins sheet 19)
260 000 FEET
2 530 000 FEET
(Joins sheet 29)
1 Mile
5000 Feet
Scale · 1 : 20000
Creek
Spring
w

BRYAN COUNTY, OKLAHOMA — SHEET NUMBER 21


N
(Joins sheet 14)
R. 12 E.
2 600 000 FEET
2 570 000 FEET
T. 6 S.
(Joins sheet 21)
(Joins sheet 23)
2 580 000 FEET
2 560 000 FEET
(Joins sheet 31)
1 Mile
5000 Feet
0
Scale · 1:20000
1 000
2000
3000
4000
5 000
Oakall Spring
Bois d'Arc Creek
Old Bennington
Whitegrass Creek
Sugarloaf Creek
Sulphur Creek
Rabbit Creek
5
4
3
2
6
7
8
9
10
11
12
13
14
15
16
17
18

2 605 000 FEET

R. 12 E. | R. 13 E.

(Joins sheet 15)

270 000 FEET

T. 6 S.

(Joins sheet 22)

Spring

Waters Creek

CHOCTAW COUNTY

1 Mile

5 000 Feet

Scale · 1:20000

260 000 FEET

2 620 000 FEET

(Joins sheet 32)

(24)

N

1 Mile
5000 Feet

Scale 1:20000

R. 7 E. 2 433 000 FEET

(Joins lower right)

LAKE TEXOMA

MARSHALL COUNTY

T. 7 S.

235 000 FEET

(Joins sheet 33)

225 000 FEET

2 431 000 FEET

2000 AND 5000-FOOT GRID TICKS

R. 6 E. | R. 7 E.

2 430 000 FEET

295 000 FEET

MARSHALL COUNTY

T. 6 S.

(Joins sheet 25)

LAKE TEXOMA

ROOSEVELT MEMORIAL BRIDGE

MARSHALL COUNTY

240 000 FEET

2 420 000 FEET

(Joins inset, upper left)

25

2 435 000 FEET

R. 7 E. | R. 8 E.

(Joins sheet 16)

255 000 FEET

N

LAKE TEXOMA

T. 6 S.

(Joins sheet 24)

(Joins sheet 26)

Mead

SAN FRANCISCO

ST. LOUIS

Neatherly water Creek

Double Spring Creek

water

1 Mile

5000 Feet

Scale 1:20000

240 000 FEET

(Joins sheet 33)

2 455 000 FEET

(26)

N

(Joins sheet 17)

R. 8 E.

2 480 000 FEET

255 000 FEET

T. 6 S.

(Joins sheet 25)

(Joins sheet 27)

2 460 000 FEET

(Joins sheet 34)

2 440 000 FEET

Scale 1:20000

1 Mile 5000 Feet

0 0 1/4 1000 1/2 2000 3/4 3000 1 4000 5000

Neuberry Creek

Mineral

Chuckwa Creek

Bayou

Rock Creek

SAN FRANCISCO ST. LOUIS

Kiersey

water

2 485 000 FEET

R. 9 E.

(Joins sheet 18)

255 000 FEET

T. 6 S.

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 35)

245 000 FEET

2 505 000 FEET

N

Scale 1:20000

1 Mile

5000 Feet

Southeastern Oklahoma State University

DURANT
(county seat)

Chuckwa Creek

Bayou Mineral

Mineral Bayou

GULF, TEXAS AND KANSAS

OKLAHOMA, KANSAS AND MISSOURI

ST. LOUIS SAN FRANCISCO

19 20 21 22 23
30 29 28 27 26
31 32 33 34 35

28

N

R. 9 E. | R. 10 E.

T. 6 S.

(Joins sheet 19)

(Joins sheet 27)

(Joins sheet 29)

(Joins sheet 36)

2 530 000 FEET

2 510 000 FEET

245 000 FEET

235 000 FEET

1 Mile

5 000 Feet

Scale 1:20000

0 0 1/4 1000 1/2 2000 3/4 3000 1 4000 5000

Blue River

Kamola Creek

Kamola Creek

Blue River

Sandy Creek

Pirtle

SAN FRANCISCO ST. LOUIS

water

23 24 19 20 21

26 25 30 29 28

35 36 31 32 33

2 530 000 FEET

255 000 FEET

R. 10 E. | R. 11 E.

(Joins sheet 20)

T. 6 S.

(Joins sheet 28)

(Joins sheet 30)

245 000 FEET

(Joins sheet 37)

2 550 000 FEET

N

Scale 1:20000

1 Mile

5 000 Feet

Blue

Rock Creek

Caney Branch

Rocky Creek

BLUE RIVER

SAN FRANCISCO ST LOUIS

water

water

N

R. 9 E. | R. 10 E.

ATOKA COUNTY

2 510 000 FEET

300 000 FEET

T. 5 S.

(Joins sheet 2)

(Joins sheet 4)

Caddo

TEXAS

KANSAS

MISSOURI

Davis Creek

Caddo Creek

69 75

22

2 525 000 FEET

(Joins sheet 11)

290 000 FEET

1 Mile

5000 Feet

Scale 1:20000

N

(Joins sheet 21)

R. 11 E.

2 575 000 FEET

265 000 FEET

T. 6 S.

(Joins sheet 31)

(Joins sheet 29)

245 000 FEET

2 555 000 FEET

(Joins sheet 38)

Bokchito

ST. LOUIS — SAN FRANCISCO

SEWAGE DISPOSAL

Chanel Creek

Creek

Bokchito

water

water

1 Mile

5000 Feet

Scale 1:20000

0 0 ¼ 1000 ½ 2000 ¾ 4000 1 5000

2 580 000 FEET

R. 12 E.

(Joins sheet 22)

N

T. 6 S.

(Joins sheet 32)

(Joins sheet 30)

(Joins sheet 39)

2 600 000 FEET

1 Mile

5,000 Feet

Scale 1:20000

Bennington

Rabbit Creek

Muddy Boggy Creek

Rock Creek

Sulphur Creek

Sassafras Creek

McGee Creek

Branch

ST. LOUIS

SAN FRANCISCO

32

N

(Joins sheet 23)

R. 12 E.

R. 13 E.

2 620 000 FEET

(Joins sheet 31)

T. 6 S.

CHOCTAW COUNTY

245 000 FEET

255 000 FEET

(Joins sheet 40)

2 605 000 FEET

1 Mile

5 000 Feet

Scale 1:20000

Whitegrass Creek

St. Louis San Francisco

Whitegrass Creek

Water

33

N

2 435 000 FEET

R. 7 E. | R. 8 E.

(Joins sheet 25)

235 000 FEET

T. 7 S.

LAKE TEXOMA

SAN FRANCISCO

ST. LOUIS

Lakeside

Double Stump Branch

Rock Creek

Tadler Creek

Mineral Creek

(Joins inset, sheet 24)

(Joins sheet 34)

(Joins sheet 41)

2 455 000 FEET

1 Mile

5000 Feet

Scale 1:20000

N

(Joins sheet 26)

R. 8 E.

2 480 000 FEET

T. 7 S.

(Joins sheet 33)

(Joins sheet 35)

2 460 000 FEET

(Joins sheet 42)

1 Mile

5 000 Feet

Scale · 1 : 20000

CALERA

BRYAN COUNTY, OKLAHOMA — SHEET NUMBER 35

35

N

2 485 000 FEET

R. 9 E.

(Joins sheet 27)

240 000 FEET

T. 7 S.

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 43)

2 505 000 FEET

225 000 FEET

1 Mile

5000 Feet

Scale 1:20000

0 0 ¼ ½ ¾ 1

1 000 2000 3000 4000 5000

Mineral Bayou

TEXAS

KANSAS

MISSOURI

ST. LOUIS

SAN FRANCISCO

Kanola Creek

water

69 75 Bus

36

N

R. 9 E. | R. 10 E.

(Joins sheet 28)

2 530 000 FEET

240 000 FEET

T. 7 S.

(Joins sheet 37)

27

(Joins sheet 35)

1 Mile

5000 Feet

Scale · 1 : 20000

2 510 000 FEET

(Joins sheet 44)

BRYAN COUNTY, OKLAHOMA — SHEET NUMBER 37

37

N

2 535 000 FEET

R. 10 E. | R. 11 E.

(Joins sheet 29)

240 000 FEET

T. 7 S.

(Joins sheet 36)

(Joins sheet 38)

230 000 FEET

2 550 000 FEET

(Joins sheet 45)

Cedar Creek

BLUE

Rock Creek

RIVER

Caddo Creek

BLUE RIVER

Purcell Creek

1 Mile

5000 Feet

Scale 1:20000


N
(Joins sheet 30)
R. 11 E.
2 575 000 FEET
240 000 FEET
T. 7 S.
(Joins sheet 37)
(Joins sheet 39)
230 000 FEET
2 555 000 FEET
(Joins sheet 46)
Charley Creek
Bokchito Creek
BLUE RIVER
Cherokee Lake
1 Mile
5 000 Feet
Scale · 1 : 20000

2 580 000 FEET

R. 12 E.

(Joins sheet 31)

240 000 FEET

T. 7 S.

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 47)

2 600 000 FEET

230 000 FEET

N

Scale 1:20000

1 Mile

5000 Feet

(4)

N

1 Mile
5000 Feet

Scale · 1 : 20000

ATOKA COUNTY

R. 10 E. | R. 11 E.

2 550 000 FEET

300 000 FEET

T. 5 S.

(Joins sheet 3)

(Joins sheet 5)

2 530 000 FEET

(Joins sheet 12)

40

N

R. 12 E. | R. 13 E.

(Joins sheet 32)

2 625 000 FEET

240 000 FEET

T. 7 S.

CHOCTAW COUNTY

(Joins sheet 39)

230 000 FEET

2 605 000 FEET

(Joins sheet 48)

(Joins inset, sheet 49)

Scale 1:20000

1 Mile

5 000 Feet

Wolf Creek

Sandy Creek

Whitegrass Creek

water

w

N

2 435 000 FEET

R. 7 E. | R. 8 E.

(Joins sheet 33)

220 000 FEET

T. 7 S.

LAKE TEXOMA

LAKE TEXOMA

Platter

SAN FRANCISCO

ST. LOUIS

(Joins inset B, sheet 50)

(Joins sheet 42)

(Joins sheet 51)

2 455 000 FEET

210 000 FEET

1 Mile

5 000 Feet

Scale 1:20000

(42)

N

1 Mile
5,000 Feet

Scale 1:20000

(Joins sheet 34)

R. 8 E.

2 480 000 FEET

(Joins sheet 41)

(Joins sheet 43)

T. 7 S.

2 460 000 FEET

(Joins sheet 52)

CALERA

SEWAGE DISPOSAL

TEXAS

KANSAS

MISSOURI

Island

Bluff

Creek

water

20 21 22 23 24 25 26 27 28 29 32 33 34 35 36

2 485 000 FEET

R. 9 E.

(Joins sheet 35)

220 000 FEET

T. 7 S.

(Joins sheet 42)

(Joins sheet 44)

19 20 21 22 23

30 29 28 27 26

31 32 33 34 35

water

Sassafras Creek

Caney Creek

Allison

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 53)

2 505 000 FEET

210 000 FEET

(44)

N

1 Mile
5000 Feet
0
Scale · 1 : 20000
1/4 1000
1/2 2000
3/4 4000
1 5000

(Joins sheet 36)

R. 9 E. | R. 10 E.

2 530 000 FEET

225 000 FEET

T. 7 S.

(Joins sheet 43)

(Joins sheet 45)

210 000 FEET

2 510 000 FEET (Joins sheet 54)

Roberta

water

Creek

45

2 525 000 FEET

R. 10 E. | R. 11 E.

(Joins sheet 37)

225 000 FEET

T. 7 S.

(Joins sheet 46)

(Joins sheet 44)

2 550 000 FEET

(Joins sheet 55)

210 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 5000 1000 2000 3000 4000 5000

Utica

Wolf Creek

46

N

1 Mile 5000 Feet

Scale · 1:20000

(Joins sheet 38)

R. 11 E.

2 575 000 FEET

225 000 FEET

T. 7 S.

(Joins sheet 47)

(Joins sheet 45)

210 000 FEET

2 555 000 FEET

(Joins sheet 56)

Blue River

Creek

water

Tiklo

BRYAN COUNTY, OKLAHOMA — SHEET NUMBER 47

47

N

2 580 000 FEET

R. 12 E.

(Joins sheet 39)

2 595 000 FEET

T. 7 S.

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 57)

2 600 000 FEET

BLUE

RIVER

Sulphur Creek

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

70E

1 Mile

5 000 Feet

0

Scale 1:20000

1 000 2 000 3 000 4 000 5000

¼ ½ ¾ 1

2 15 000 FEET

BRYAN COUNTY, OKLAHOMA — SHEET NUMBER 48

48

N

(Joins sheet 40)

R. 12 E. | R. 13 E.

2 625 000 FEET

225 000 FEET

(Joins sheet 47)

T. 7 S.

(Joins sheet 49)

215 000 FEET

2 605 000 FEET

(Joins sheet 58)

Scale · 1 : 20000

1 Mile

5 000 Feet

Branch

Red

Blue River

Sibil Spring

Pulsy Spring

water


(Joins inset, lower right)
2 630 000 FEET
R. 13 E.
R. 14 E.
225 000 FEET
T. 7 S.
(Joins sheet 48)
Whitegrass
Creek
CHOCTAW
COUNTY
Creek
Whitegrass
Creek
water
(Joins sheet 59)
2 645 000 FEET
215 000 FEET
2 626 000 FEET
R. 13 E.
231 000 FEET
227 000 FEET
T. 7 S.
(Joins sheet 40)
CHOCTAW
Whitegrass
COUNTY
Creek
(Joins upper left)
2 629 000 FEET
3000 AND 4000-FOOT GRID TICKS
N
1 Mile
5000 Feet
Scale 1:20000

N

2 555 000 FEET

R. 11 E. ATOKA COUNTY

300 000 FEET

T. 5 S.

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 13)

2 575 000 FEET

290 000 FEET

Lond Branch

Turnbull Springs

Pine Creek

Buffalo Hill

Pine Creek

1 Mile

5 000 Feet

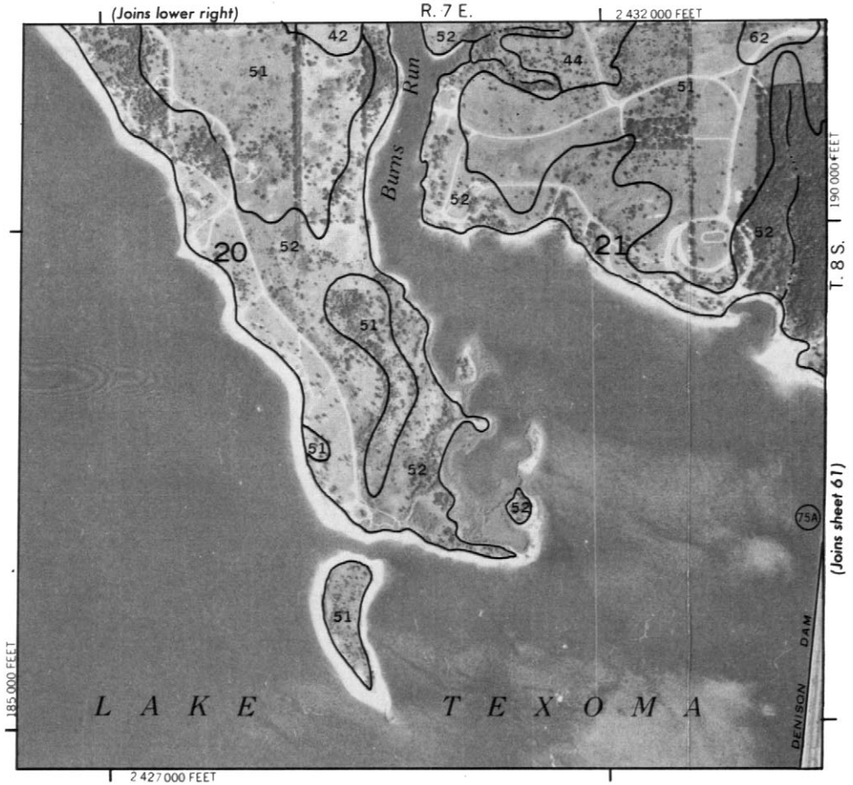
Scale 1:20000

50

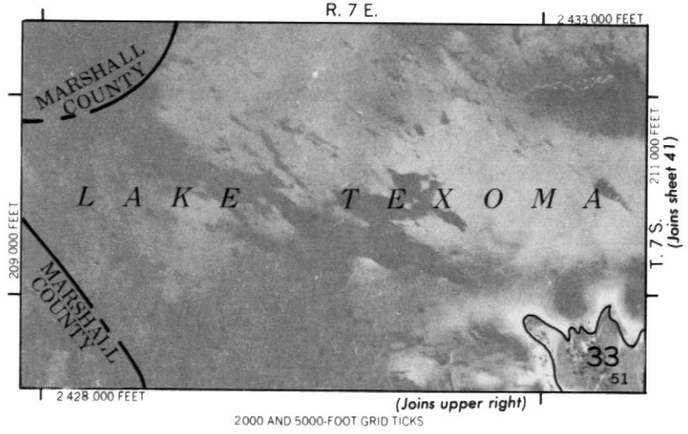
N

1 Mile
5000 Feet
Scale · 1:20000
0 0 1000 2000 3000 4000 5000

INSET A
R. 7 E.

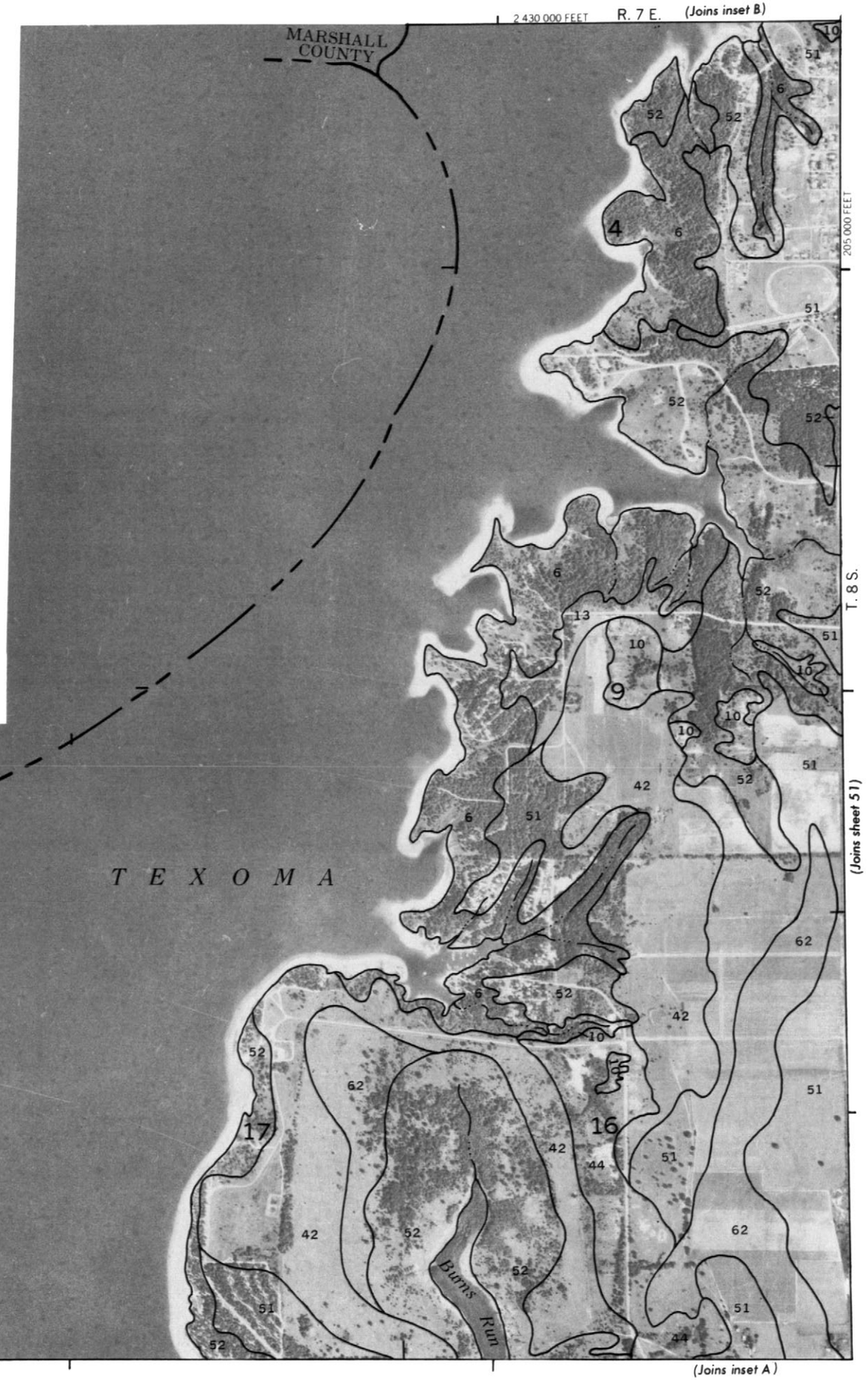


INSET B
R. 7 E.



(Joins upper right)

2000 AND 5000-FOOT GRID TICKS



N

2 435 000 FEET

R. 7 E.

R. 8 E.

(Joins sheet 41)

105 000 FEET

T. 8 S.

(Joins sheet 50)

(Joins sheet 52)

Creek

Little

Sand

Creek

water

SAN FRANCISCO

Pickwick

Cartwright

Colbert

TEXAS

KANSAS

MISSOURI

(Joins sheet 61)

2 455 000 FEET

1 Mile

5 000 Feet

Scale 1:20000

N

(Joins sheet 42)

R. 8 E.

2 480 000 FEET

T. 8 S.

205 000 FEET

(Joins sheet 51)

195 000 FEET

2 460 000 FEET

(Joins sheet 62) | (Joins sheet 63)

Scale 1:20000

1 Mile 5000 Feet

0 0 ¼ ½ ¾ 1-

1000 2000 3000 4000 5000

TEXAS

KANSAS

MISSOURI

Island Bayou

Moore Creek

Creek

South

water

N

2 485 000 FEET

R. 9 E.

(Joins sheet 43)

205 000 FEET

T. 8 S.

(Joins sheet 52)

Allison

Old Allison

Island Bayou

Carrell Creek

Island Bayou

(Joins sheet 54)

1 Mile

5000 Feet

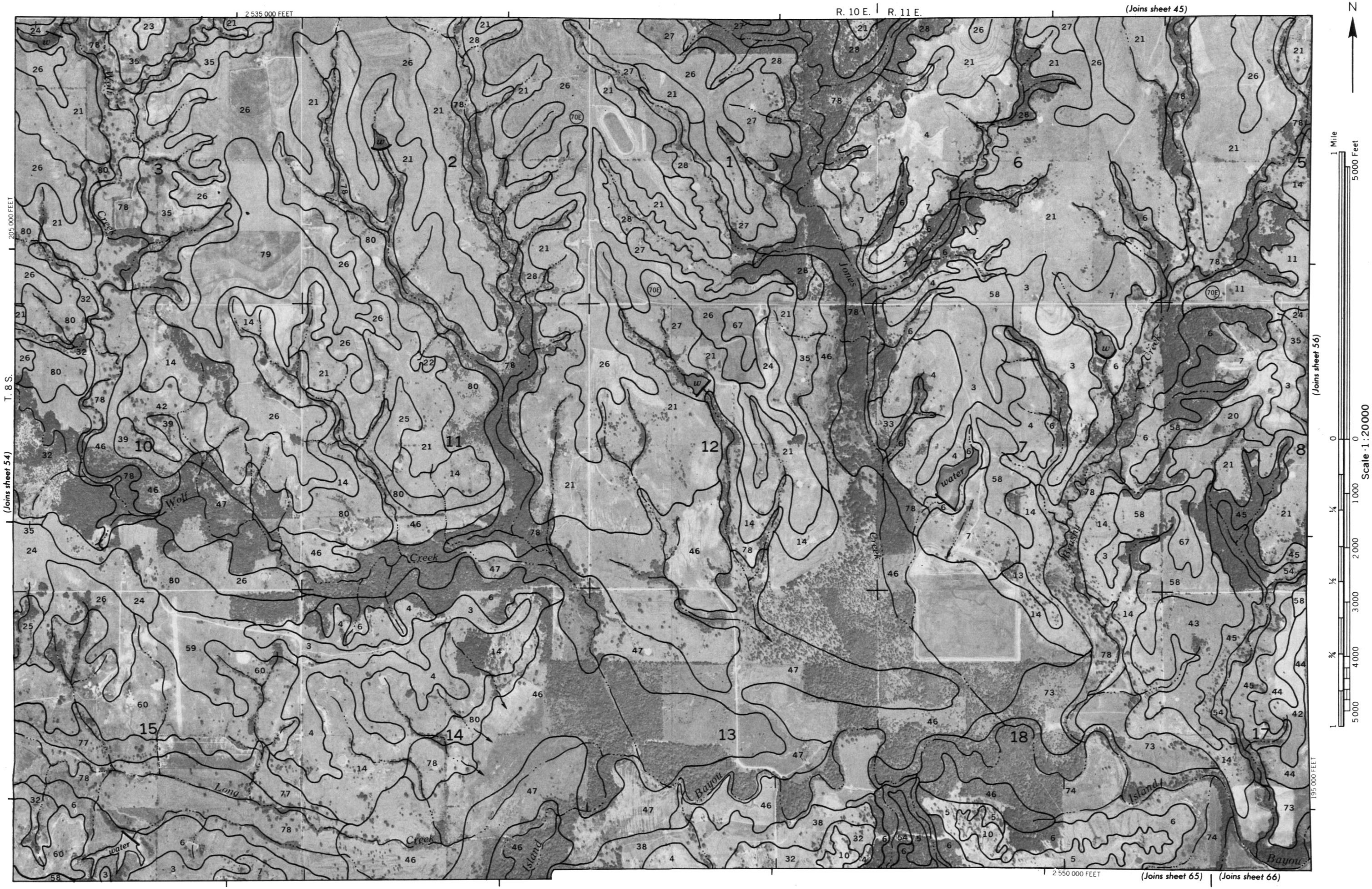
Scale 1:20000

195 000 FEET

2 505 000 FEET

(Joins sheet 63) | (Joins sheet 64)


N
(Joins sheet 44)
R. 9 E.
R. 10 E.
2 530 000 FEET
205 000 FEET
T. 8 S.
(Joins sheet 55)
(Joins sheet 53)
195 000 FEET
2 510 000 FEET
(Joins sheet 64)
(Joins sheet 65)
Sassafras Creek
water
1 Mile
5000 Feet
Scale · 1 : 20000
0
1000
2000
3000
4000
5000


2 535 000 FEET
R. 10 E.
R. 11 E.
(Joins sheet 45)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 65)
(Joins sheet 66)
T. 8 S.
205 000 FEET
195 000 FEET
2 550 000 FEET
Wolf Creek
Jones Creek
Long Creek
Island Bayou
Brushy Creek
water
N
1 Mile
5000 Feet
Scale 1:20000

N

1 Mile
5000 Feet

Scale 1:20000

(Joins sheet 46)

R. 11 E.

2,575,000 FEET

2,565,000 FEET

T. 8 S.

(Joins sheet 57)

2,555,000 FEET

(Joins sheet 66)

(Joins sheet 55)

Albany

water

Tuklo Creek

Island Bayou

2 580 000 FEET

R. 12 E.

(Joins sheet 47)

N

T. 8 S.

205 000 FEET

(Joins sheet 56)

(Joins sheet 58)

195 000 FEET

(Joins inset, sheet 75)

2 600 000 FEET

Wade

Smith-Lee

BLUE RIVER

Rice Creek

Pubblo Creek

RED RIVER

RED RIVER

FANNIN COUNTY, TEXAS

1 Mile

5000 Feet

Scale 1:20000


N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 48)
R. 12 E.
R. 13 E.
2 625 000 FEET
210 000 FEET
(Joins sheet 59)
T. 8 S.
(Joins sheet 57)
195 000 FEET
2 605 000 FEET
(Joins inset, sheet 59)
BLUE RIVER
RED RIVER
FANNIN COUNTY, TEXAS
water

59

N

2 630 000 FEET

R. 13 E.

R. 14 E.

(Joins sheet 49)

(Joins sheet 58)

210 000 FEET

T. 8 S.

RED RIVER

FANNIN COUNTY, TEXAS

Westlake

water

Whitegrass

CHOCTAW COUNTY

Crane Lake

(Joins sheet 60)

200 000 FEET

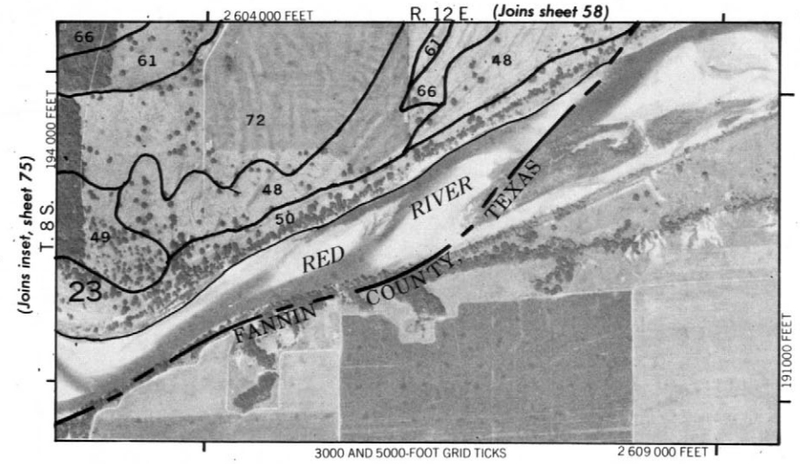
FANNIN CO., TX

1 Mile

5000 Feet

Scale 1:20000

0 0 1/4 1000 2000 1/2 3000 4000 3/4 5000 1



2 645 000 FEET

6

N

ATOKA COUNTY

R. 12 E.

2 600 000 FEET

305 000 FEET

T. 5 S.

(Joins sheet 7)

1 Mile

5 000 Feet

Scale · 1 : 20000

(Joins sheet 5)

Matoy

Creek

Straight Creek

Bois d'Arc

Branch

Harrington

290 000 FEET

2 580 000 FEET

(Joins sheet 14)

60

N

1 Mile 5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins lower left)

R. 14 E.

2 660 000 FEET

195 000 FEET

T. 8 S.

190 000 FEET

2 650 000 FEET

FANNIN COUNTY, TEXAS

RED RIVER

LAMAR COUNTY, TEXAS

21 22

(Joins sheet 59)

Whitegrass Creek

Oberlin

CHOCTAW COUNTY

R. 14 E.

2 670 000 FEET

Whitegrass Creek

Weeks

Obertin Lake

water

RED RIVER

LAMAR COUNTY, TEXAS

8 9 10 11 12 13 14 15 16 17

200 000 FEET

202 000 FEET

T. 8 S.

(Joins inset, sheet 72)

2 650 000 FEET

(Joins inset, upper right)

2000 AND 5000-FOOT GRID TICKS

61

N

R. 7 E. | R. 8 E.

2 435 000 FEET

(Joins inset A, sheet 50)

190 000 FEET

(Joins sheet 51)

Colbert

Cartwright

Staley

SEWAGE DISPOSAL

DAM

DENISON

Sand Creek

SAN FRANCISCO

TEXAS

KANSAS

water

LOUIS ST

MISSOURI

Sandy Creek

RED RIVER

GRAYSON COUNTY, TEXAS

RED RIVER

T. 8 S.

(Joins sheet 62)

180 000 FEET

(Joins sheet 67)

2 455 000 FEET

1 Mile

5000 Feet

Scale 1:20000

N

(Joins sheet 52)

R. 8 E.

2 480 000 FEET

190 000 FEET

T. 9 S.

(Joins sheet 61)

180 000 FEET

2 460 000 FEET

(Joins sheet 68)

(Joins sheet 63)

1 Mile

5000 Feet

Scale · 1 : 20000

Sandy Creek

Eastman Creek

water

20 21 22 23 24

29 28 27 26 25

32 33 34 35 36

63

N

14 (Joins sheet 52) | (Joins sheet 53) 2 485 000 FEET

R. 9 E.

190 000 FEET

T. 8 S.

Achille

Island Bayou

Island Bayou

(Joins sheet 64)

180 000 FEET

(Joins sheet 62)

(Joins sheet 69)

2 505 000 FEET

1 Mile 5000 Feet

Scale 1:20000

64

N

(Joins sheet 53) | (Joins sheet 54)

R. 9 E. | R. 10 E.

2 525 000 FEET

1 Mile
5000 Feet

Scale 1:20000

Sassafras Island Creek Bayou

water

T. 8 S.

(Joins sheet 63)

(Joins sheet 65)

(Joins sheet 70)

2 510 000 FEET

180 000 FEET

190 000 FEET

(Joins sheet 54)

2 530 000 FEET

(Joins sheet 55)

R. 10 E. | R. 11 E.

N

190 000 FEET

T. 8 S.

(Joins sheet 64)

Island Bayou

Yuba

(Joins sheet 66)

180 000 FEET

(Joins sheet 71)

2 550 000 FEET

1 Mile

5000 Feet

Scale 1:20000

66

N

(Joins sheet 54) | (Joins sheet 55)

R. 11 E.

2 575 000 FEET

(Joins inset, sheet 75)

190 000 FEET

T. 8 S.

(Joins sheet 65)

180 000 FEET

(Joins sheet 72) 2 555 000 FEET

1 Mile 5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

20 21 22 23 24 28 29 32 33

Romia

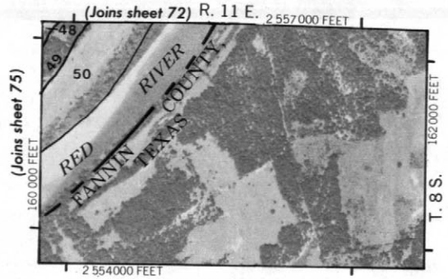
Island Bayou

intermittent water

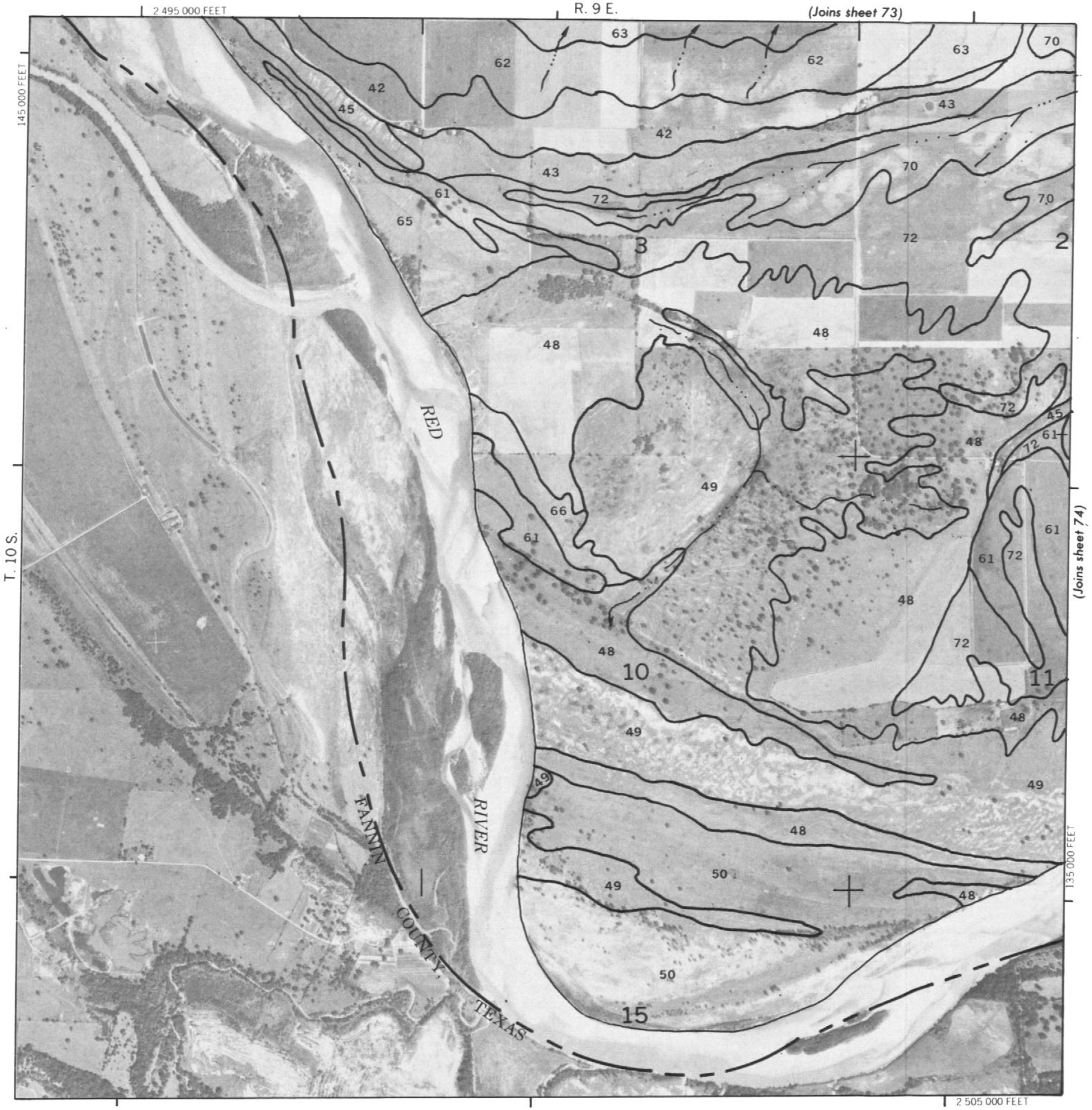
FANNIN COUNTY, TEXAS

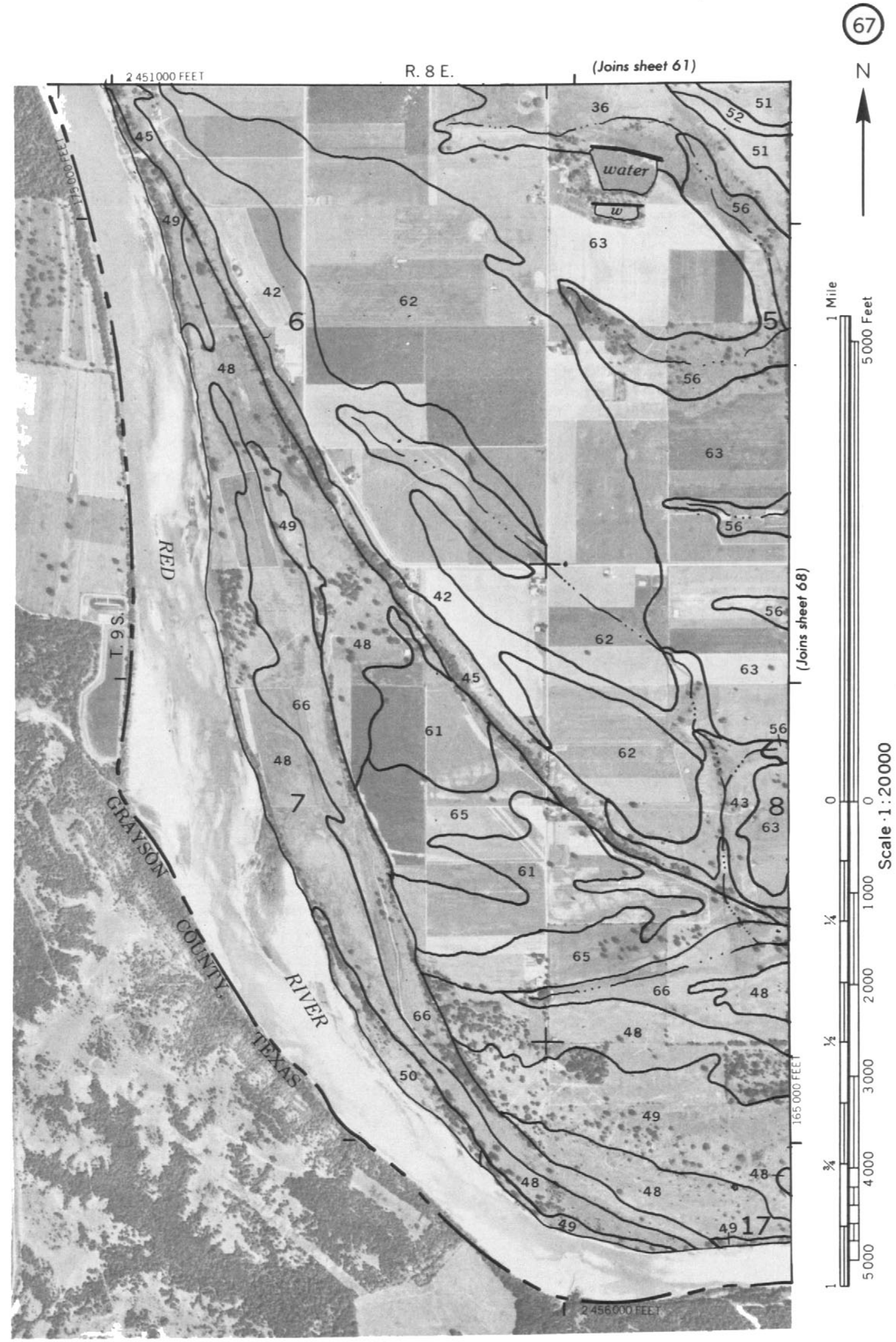
RED RIVER

Pope's Point



2000 AND 3000-FOOT GRID TICKS


2 495 000 FEET
R. 9 E.
(Joins sheet 73)
145 000 FEET
T. 10 S.
(Joins sheet 74)
135 000 FEET
2 505 000 FEET
RED
RIVER
FANNIN
COUNTY,
TEXAS
63
62
42
45
43
70
72
61
65
2
3
48
49
66
10
11
50
15


67
N
2 451 000 FEET
R. 8 E.
(Joins sheet 61)
175 000 FEET
T. 9 S.
(Joins sheet 68)
165 000 FEET
2 456 000 FEET
RED
RIVER
GRAYSON
COUNTY,
TEXAS
water
w
36
51
52
56
63
45
49
42
62
6
5
48
42
45
61
66
7
65
43
8
50
17
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1

(68)

N

(Joins sheet 62)

R. 8 E.

2 480 000 FEET

175 000 FEET

T. 9 S.

(Joins sheet 67)

(Joins sheet 69)

165 000 FEET

2 460 000 FEET

RED RIVER

GRAYSON COUNTY, TEXAS

GRAYSON COUNTY, TEXAS

Eastman Creek

Webb Creek

water

water

1 Mile

5 000 Feet

Scale 1:20000

N

2 485 000 FEET

R. 9 E.

(Joins sheet 63)

175 000 FEET

T. 9 S.

(Joins sheet 68)

(Joins sheet 70)

Webb Creek

Rock Creek

Greenwood Creek

Sandy Creek

Hendrix

Kemp

(Joins sheet 73)

2 505 000 FEET

165 000 FEET

1 Mile

5000 Feet

Scale 1:20000


ATOKA COUNTY
2 605 000 FEET
R. 12 E.
R. 13 E.
305 000 FEET
T. 5 S.
(Joins sheet 6)
Mossy Lake
CLEAR BOGGY CREEK
CHOCTAW COUNTY
Branch
Harrington Creek
Rabbit Creek
Dancing
Shatmee Creek
CLEAR BOGGY CREEK
CHOCTAW COUNTY
295 000 FEET
2 620 000 FEET
(Joins sheet 15)
1 Mile
5000 Feet
Scale 1:20000
N
7


(Joins sheet 64)
R. 9 E.
R. 10 E.
2 525 000 FEET
175 000 FEET
T. 9 S.
(Joins sheet 71)
(Joins sheet 69)
165 000 FEET
(Joins sheet 74)
2 510 000 FEET
Brown Creek
Brown Creek
Chewa Creek
Muddy Creek
Yarnaby
RED RIVER
FANNIN COUNTY, TEXAS
1 Mile
5000 Feet
Scale · 1 : 20000

71

N

2 530 000 FEET

R. 10 E. | R. 11 E.

(Joins sheet 65)

175 000 FEET

T. 9 S.

(Joins sheet 70)

Yuba

Yarnaby

Karma

Brown Creek

(Joins sheet 72)

1 Mile

5000 Feet

Scale 1:20000

165 000 FEET

(Joins sheet 75)

2 550 000 FEET

N

1 Mile 5000 Feet

Scale 1:20000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

(Joins sheet 66) R. 11 E 2 575 000 FEET

(Joins sheet 71) 175 000 FEET

T. 9 S.

T. 8 S.

202000 FEET

197000 FEET

165 000 FEET

(Joins inset, 66) 2 555 000 FEET

R. 15 E. 2 680 000 FEET

(Joins sheet 60) 2 675 000 FEET

FANNIN COUNTY TEXAS

RED RIVER

CHOCTAW COUNTY

Whitegrass Creek

LAMAR COUNTY TEXAS

RED RIVER

This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners if shown are approximately positioned

73

N

2 485 000 FEET

R. 9 E.

(Joins sheet 69)

160 000 FEET

(Joins inset, lower right)

T. 9 S.

(Joins sheet 74)

150 000 FEET

Sandy Creek

Trapper Creek

Skinner Creek

Liberty

RED RIVER

GRAYSON COUNTY, TEXAS

19 20 21 22 23 26 27 28 29 33 34 35

(Joins inset, sheet 67)

2 505 000 FEET

1 Mile

5000 Feet

0

Scale 1:20000

1 000 2000 3000 4000 5000

R. 8 E.

2 481 000 FEET

160 000 FEET

T. 9 S.

158 000 FEET

(Joins upper left)

2 482 000 FEET

1000 AND 2000-FOOT GRID TICKS

N

Scale · 1 : 20000

1 Mile 5000 Feet

0 0

¼ 1000

½ 2000

¾ 4000

1 5000

(Joins sheet 70)

R. 9 E. | R. 10 E.

2 525 000 FEET

RED RIVER

FANNIN COUNTY, TEXAS

(Joins sheet 75)

100 000 FEET

(Joins sheet 73)

150 000 FEET

Pepper Creek

FANNIN COUNTY, TEXAS

RED RIVER

(Joins lower left)

R. 9 E.

2 515 000 FEET

145 000 FEET

(Joins inset, sheet 67)

T. 9 S.

T. 10 S.

135 000 FEET

FANNIN COUNTY, TEXAS

RED RIVER

2 510 000 FEET

(Joins inset, upper right)

2 510 000 FEET

75

N

2 530 000 FEET

R. 10 E. | R. 11 E.

(Joins sheet 71)

(Joins sheet 74) 161 000 FEET

(Joins inset, sheet 66)

T. 9 S.

22 23 24 19 20

FANNIN COUNTY, TEXAS

RED RIVER

156 000 FEET

2 550 000 FEET

(Joins sheet 57)

R. 12 E.

2 580 000 FEET

(Joins sheet 66) 194 000 FEET

T. 8 S.

19 20 21 22

Rice Creek

RED RIVER

FANNIN COUNTY, TEXAS

(Joins inset, sheet 59) 191 000 FEET

2 600 000 FEET

3000 AND 5000-FOOT GRID TICKS

1 Mile

5 000 Feet

Scale 1:20000

N

R. 7 E. | R. 8 E.

JOHNSTON COUNTY

2 455 000 FEET

285 000 FEET

T. 5 S.

LAKE TEXOMA

Spring

Fort Washita

Kansas Creek

WASHITA RIVER

CUMBERLAND LEVEE

CUMBERLAND CUT

Rock Creek

OLD CHANNEL

MARSHAL COUNTY

LAKE TEXOMA

Moore Widow Creek

water

22 23 24 19 20 27 26 25 30 29 34 36 31 32

(Joins inset, sheet 1)

275 000 FEET

2 435 000 FEET

(Joins sheet 9)

(Joins sheet 16) | (Joins sheet 17)

1 Mile

5 000 Feet

Scale 1:20000

0 1/4 1/2 3/4 1

1 000 2 000 3 000 4 000 5 000

BRYAN COUNTY, OKLAHOMA — SHEET NUMBER 9

9

N

2 460 000 FEET

JOHNSTON COUNTY

R. 8 E.

(Joins sheet 1)

285 000 FEET

T. 5 S.

(Joins sheet 10)

(Joins sheet 8)

(Joins sheet 17)

2 480 000 FEET

275 000 FEET

TWELVEMILE

PRAIRIE

Bois d'Arc Creek

Little Blue River

Brown

1 Mile

5000 Feet

Scale 1:20000